American Gas *Association* MONTHLY

The Storage of Natural Gas

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Heating Basementless Houses

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Brooklyn Looks at Gas Range

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Gas Radiant-Tube Heating

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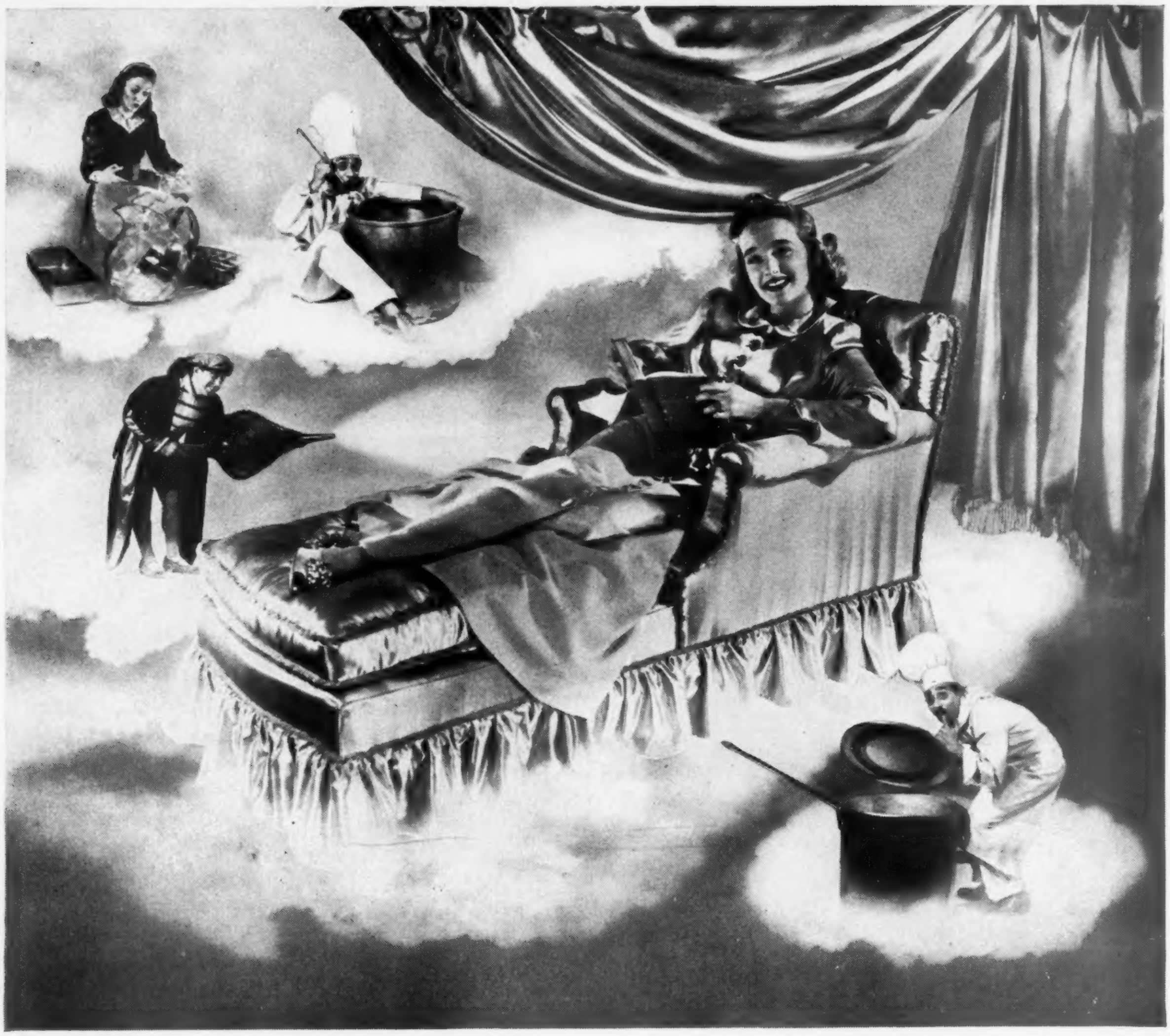
The Residential Gas Program

AMERICAN GAS ASSOCIATION · LIGHT · HEAT · POWER · INCORPORATED 1919

February 1944

VOLUME XXVI NUMBER 2



"...and I'll live like a queen in a house that takes care of itself..."

IT'S A DREAM, of course! Even your home of tomorrow won't completely "run itself"! But it will be easier to manage, more fun to live in than any house you ever hoped for! In fact, here are a few of the things which engineers in the laboratories of the Gas industry are planning for you *right now*.

AN ALL-YEAR-ROUND PERFECT CLIMATE — Your new Gas air-conditioning system will keep your home warm in winter, cool in summer . . . give you fresh, clean, balanced air at a moment's notice — all from one compact unit operated by the spotless fuel, GAS.

A WONDER KITCHEN — Marvelously cool and clean — where a new Certified Performance Gas range, equipped with *new heat controls,* will give you "precision cooking" . . . *better* meals with less drudgery!

HOT WATER GALORE — Your new automatic Gas water-heating system will give you oceans of hot water whenever you want it — make all housekeeping easier.

MAGIC REFRIGERATION — Your new silent Gas refrigerator, with greater storage facilities, will make it easier to keep all kinds of food fresh longer—meats, vegetables, even frozen foods . . . will save you hours of marketing time, give your family greater variety.

Our dreams of a better world are coming true. It is a world worth planning and saving for—with every War Bond you can buy.

Remember . . . Gas today speeds war production. Use it wisely. Tomorrow it will bring you new ease, new leisure, better living.

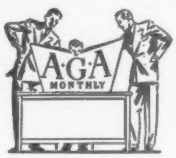
THE MAGIC FLAME THAT WILL BRIGHTEN YOUR FUTURE

GAS

An advertisement of the American Gas Association

American Gas Association MONTHLY

CONTENTS FOR FEBRUARY 1944



In the race for postwar markets, the gas industry must do two things, says Howard Myers in a provocative article. First, it must match dollar for dollar, insofar as possible, the promotion of its competitors; second, it must outmatch them in developing new ideas. And that's no globaloney! . . . In a scholarly thesis, J. French Robinson discusses the four methods of storing natural gas and their significance in the postwar fuel economy. As head of a company which has pioneered in liquefied and underground storage, he is well qualified to analyze developments and possibilities. . . . With low-cost housing destined to play an important postwar role, Public Service steps to the front with a gas heating system that has definite advantages. Mr. Morehouse describes it in an able report. . . . In many respects the Brooklyn range survey backs up the findings of the Chicago survey, reported last month. A substantial body of opinion is now on record in regard to the postwar gas range and it will be interesting to see if other developments coincide with the present trend. . . . Mr. Whitten's story of gas radiant-tube heating further substantiates the belief that this development was a boon to the country.

SUBSCRIPTION · $3.00 A YEAR

Published eleven times a year by the American Gas Association, Inc. Publication Office, American Building, Brattleboro, Vt. Publication is monthly except July and August which will be a bi-monthly issue. Editorial Offices, 420 Lexington Avenue, New York 17, N. Y. Address all communications to American Building, Brattleboro, Vermont, or to 420 Lexington Ave., New York 17, N. Y. All manuscript copy for publication should be sent to the editorial offices in New York. The Association does not hold itself responsible for statements and opinions contained in papers and discussions appearing herein. Entered as Second Class Matter at the Post Office at Brattleboro, Vermont, February 10th, 1922, under the Act of March 3, 1879.

Cable Addresses: American Gas Association
AMERIGAS, NEW YORK
American Gas Association Testing Laboratories
AMERIGASLAB, CLEVELAND

THE GAS INDUSTRY IN BRITAIN—One of the large holders in which gas is stored until distributed to consumers. This striking photograph was taken by the British Council.

American Gas
Association
MONTHLY

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JAMES M. BEALL, *Editor*

GAS HORIZON

. . . Postwar Business Awaits Industry with Ideas

By HOWARD MYERS
Publisher, The Architectural Forum

Howard Myers

THESE are days when anyone who discusses postwar markets has to get up in the stratosphere in order not to be a piker. The magazines, including our own, have been full of fascinating ideas on houses, including such models as the disposable or kleenex house, the all-glass or Gypsy Rose Lee house, the underground or World War III house, and the circular or Hamburger Heaven house. Obviously, it is going to be a brave, new world with none so brave as the new home owner.

All of this noodling, even though somewhat fanciful, is not unimportant. New ideas have a way of emerging as crack-pot schemes, and somewhere along the line someone steps in, reduces the crack-pot content, and the world moves forward.

At the other extreme, we have the people who reject every new idea, and the building business is full of these. In between is the way to a fine, healthy, sustained period of building. But it is well to recognize at this time that the prophets of doom and complacency are, if anything, more harmful to postwar prosperity than the prophets of boom and the sky-is-the-limit.

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If we are gradually to work up to a level of a million housing units or more a year and all the other buildings that go with it, what sort of a postwar house will really build that market? First, on the average, it will have to cost less; second, it will have to look better; third, it will have to be planned very much better; fourth, it will have to be a complete house, fully equipped for easy and gracious living.

These are generous and general requirements, and they should be because if we achieve these objectives, it will not be by freezing the house into a standardized solution but by expressing these needs in various ways to attract various tastes in various parts of the country.

In mentioning the complete house that brings the whole picture into the focus of the gas industry. Up to now, building has been operating a shell game; the buyer buys the shell but not the complete house equipped with all of the necessary devices which taken together spell "liveability." Without boring you with the details, let me say that the *Forum* has been working with equipment manufacturers, with the FHA, with home builders and other interested groups in trying to get FHA mortgage insurance to cover these items. At the moment, we are approaching Rome with this program but are still not in Berlin. At the right time, we will invite you to come in and deliver the finishing punch.

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I am sure no discussion of postwar housing would be complete without mentioning prefabrication. Perhaps the most important thing to realize about prefabrication is that it has passed the tall-talk stage and is now a three-dimensional reality with more than 100,000 families living in such structures. As you know, prefabrication is another of those loose terms used to describe everything from complete factory-built jobs shipped to the site on a truck, to houses made of larger than conventional pieces, either in a factory or at the site, and erected on the job. Which particular kind of prefabrication you favor is not very important, nor for that matter is prefabrication important as an academic idea. What is important is the promise prefabrication holds to make possible good houses at lower cost than conventional methods. If it does that, you have to be in favor of it and so do we, because your business will be better and so will ours.

There is nothing inherent in prefabrication which makes it more difficult for gas installations than for any gas substitute.

But the postwar market is not going to teeter on the presence of prefabrication. Currently it appears to offer engaging possibilities and may account for 10 per cent of the early market and eventually a much larger percentage.

Prefabrication or no, here are some of the specific ideas which your industry might well explore. For the following notes, I am indebted to our technical editor, Henry Wright. These ideas cover cooking, refrigeration, domestic hot water and heating and cooling.

Cooking

The gas people must be, if anything, ahead of the electrical field in making basic improvements in kitchen ranges. The cooking unit used in the Libbey-Owens-Ford kitchen illustrates most of the improvements that are currently being talked about, including a high oven with a motor-operated glass-front range and a revolving spit on the same motor, a movable heating element which can be used for vertical broiling and open frying as well as baking. The cooking top proper consists of a series of recessed utensils with individual thermostat and time controls for each utensil. There is also a built-in combination griddle and waffle iron, and special steam heated "wells" for warming canned food in the can. All of these things should be at least as feasible with gas fuel as with electricity, and while it is unlikely that all or most of them will figure in an immediate practical way in the postwar stove, they are all good ideas worth trying.

Refrigeration

As with the range, the gas refrigerator should also try to get out in front and stay there. This would probably mean inclusion of quick-freeze equipment and storage space for frozen foods as well as special provision for dehydrated foods and provision for thawing out frozen foods. A development of some years back that shows considerable promise was a combination of gas refrigerator with a water heater, utilizing the heat released in the refrigeration process for heating water. There might also be an important tie-up between gas refrigeration and gas air conditioning.

This straight talk from Howard Myers, one of the country's leading magazine publishers and a recognized authority on postwar building trends, should prove stimulating to the gas industry. It was first presented November 19, 1943 at the New York-New Jersey sales managers' roundtable sponsored by the American Gas Association.

Domestic Hot Water

In this field the leadership of gas is presently undisputed, but with electrical rates continually falling and the efficiency of electrical equipment continually rising, the gas people will have to keep on their toes to maintain it. Present equipment is highly efficient so far as the heating and storage of water are concerned, and could scarcely be improved in this respect, although units might be redesigned to fit better into kitchens with the elimination of basements. The utilization of the water produced, however, is highly inefficient, due mostly to cooling in the supply piping. And this also makes the resulting service far from satisfactory, since there is always a waiting period for the pipes to empty cold water before the faucet labeled "hot" begins to deliver hot water. Comparatively simple improvements in plumbing practice, which would involve an insulated loop supply, so that hot water would continually circulate in the pipes and be instantaneously available at every faucet, would improve the service, result in considerable conservation in water and some saving in fuel.

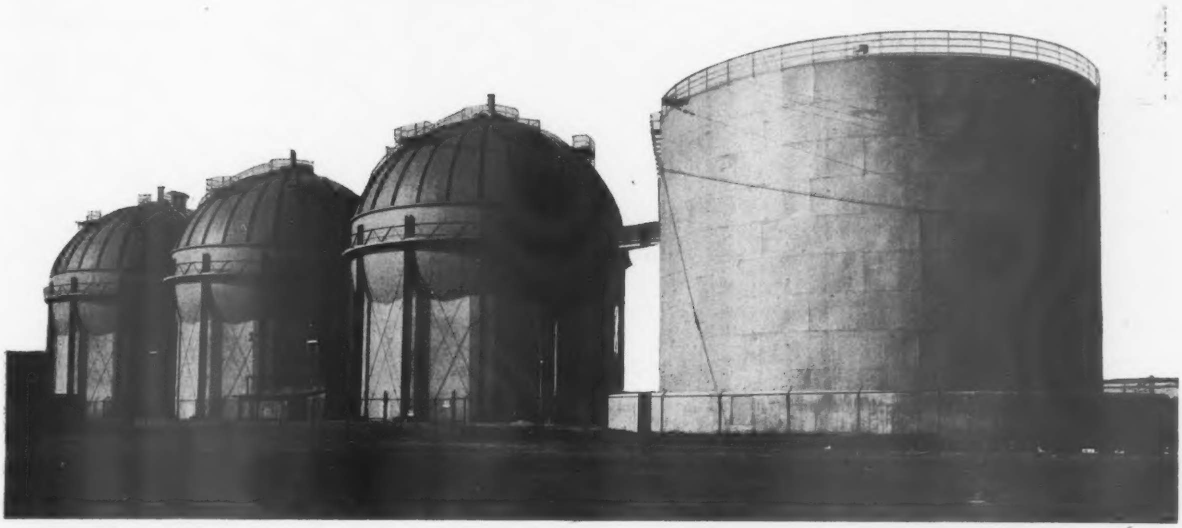
Heating and Cooling

Gas heating equipment is certainly most convenient and efficient, the only barrier to its universal use being the higher cost of gas fuel in many areas. The trend towards smaller, better insulated houses, and the need for heating equipment which can be placed on the first floor of basementless houses are both favorable factors as far as gas is concerned. Year-round air conditioning, with a combination gas-fired heating and cooling unit, offers the possibility of a very considerable increase in domestic gas consumption, on a basis which could apparently compete very successfully with any combination of other fuels for the purposes.

Perhaps I am far enough away from your business to have a somewhat detached view about it. Since you have asked me to appraise gas in the postwar building program, I would say that the major threat to your future is the fact that your competition is very well heeled and very aggressive. That, it seems to me, means two things: one, you have to match that aggression, dollar for dollar, to the top limit of your bankroll. That is an absolute must if the people who design and build houses are going to be gas minded and if the public which buys or rents them is to be gas minded. Obviously, that means not only the right amount but the right kind of advertising and certainly it means, among other things, giving architects and builders the right kind of technical information which they need to put your ideas to use.

Matching Dollars Not Enough

But also, it means one other very important thing. Just matching dollars is no guarantee of success. What the gas industry has to do is outmatch competition in being progressive and willing to promote new ideas. I have already indicated what some of these ideas might be. There are, of course, others. It might be argued that a utility company which does not manufacture equipment cannot control the products which come to you for sale. To that I say you have tremendous influence on what equipment manufacturers make and that influence can be used to guide the manufacturer in his research and production. I do not wish to close on an ominous note, but if the gas industry does not take the lead in initiating and in vigorously promoting sound new ideas, you may find that the postwar buyer has gas in his stomach but electricity in his heart.



Liquefaction plant in Cleveland—View of three spheres and new toro-segmental tank, showing concrete dikes

The Storage of Natural Gas

By J. French Robinson

President, The East Ohio Gas Co., Cleveland, Ohio

J. French Robinson

THERE was a time, and it was a long time, when the natural gas industry was divided into three parts, like ancient Gaul, and the people generally thought of it in terms of three divisions. The three parts were production, transmission and distribution. Today a fourth part, closely integrated with all the other three, must be added to the natural gas industry and included in all thinking and planning connected with it.

In recent years, due to increasing industrial, commercial and domestic consumer requirements, peak demands for natural gas have been created, particularly in winter, that cannot be met with the available output of existing gas fields, by the capacity of existing gas transmission systems, or with the maximums of both. Where this situation exists, or can be predicted, it is necessary to store natural gas by one or more of several methods during periods of low demand for use when demands rise to the point where they cannot be met from the usual sources of supply. Storage of gas becomes the only answer. It is an established and a rapidly developing practice in the operations of many natural gas companies. Hence this exploration of the subject is certainly pertinent, and may be useful, to the entire natural gas industry.

Natural gas can be stored by four general methods: first, as gas at low pressure in the conventional cylindrical gas holders; second, as gas in gas holders under medium pressures of from five to twenty-five pounds; third, as a liquid, at extremely low temperatures in well-insulated alloy steel tanks; and fourth, underground, as gas, at high pressures in the pore space within certain geological horizons, usually in depleted or partially depleted natural gas fields.

The conventional low pressure gas holders came into existence with the manufactured gas industry many years ago and are used by it primarily. Many natural gas companies originally were either manufactured gas companies, or, in the course of their expansion, have absorbed or inherited manufactured gas plants and therefore own gas holders.

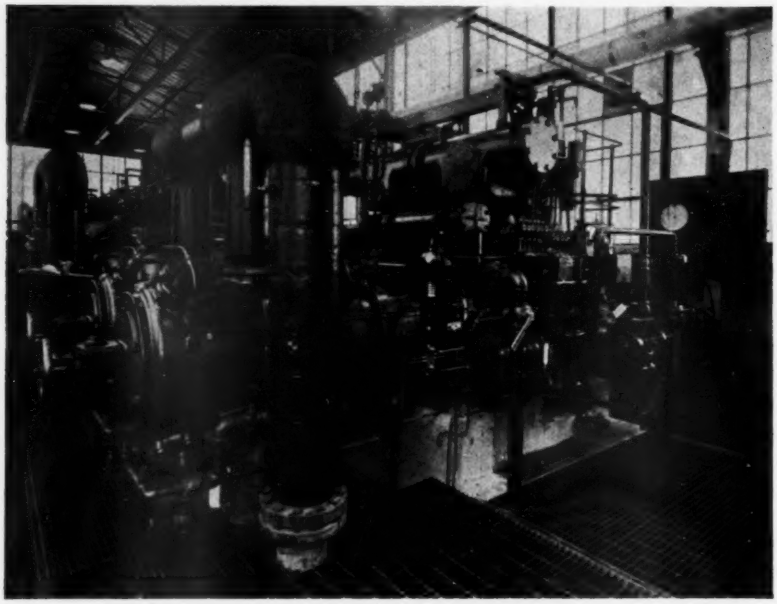
This article was prepared for publication in the February, 1944, issue of "The West Virginia Engineer." Permission to reproduce it in the MONTHLY has been generously granted.

These holders are of two general types: the older water-sealed kind, where an inverted cylindrical tank alternately rises and falls within a tank of water as the gas is admitted or is withdrawn; and the newer, so-called dry holder, in which the holder roof is really a piston that rises and falls inside the cylindrical holder wall.

These low pressure holders vary in capacity from very small to a maximum of 20,000,000 cubic feet. The latter may have a diameter of 325 feet. Very large dry holders are as high as 400 feet.

Natural gas companies which have holders in their possession find them useful, within certain fairly well defined limitations, for storing natural gas to be used during peaks to balance the supply with the demand. As the total capacity of the holders which a natural gas company may have is usually a small percentage of the company's peak daily demand, the natural gas stored in low pressure holders can

Panoramic view of liquefaction plant and low-pressure water-sealed storage holder



Interior view of compressor building, showing gas engine driven compressors—also part of the Cleveland liquefaction plant

only be used to meet short peaks or peaks that are relatively low.

The present-day cost of constructing low pressure gas holders is about $80,000 per million cubic feet of storage capacity, and is so high as to be prohibitive of consideration when the storage of very large quantities of natural gas is under discussion.

A second method of storage is the one, long in quite common use, by which gas is compressed into closed steel containers of varying shapes and sizes, at pressures ranging from five to thirty pounds per square inch. Storage of this type finds favor in small communities and in outlying residential areas of large cities where hourly or daily load peaks can be absorbed by the use of such storage containers. In many cases these are made entirely automatic, emptying or filling as the demand rises or falls.

The cost of construction with this type of storage is at the rate of approximately $200,000 per million cubic feet of storage capacity.

A third method of natural gas storage which has been demonstrated as highly successful but is still so new as almost to be unique, is the liquefaction of gas and storing it in liquid form for regasifying and distribution when needed. Natural gas stored in liquid form occupies only about one six-hundredth of the space required in the low pressure holder. Contrary to the general belief, gas is liquefied by a combination of refrigeration and compression, rather than principally by compression, which is a commonly held supposition. In this process, gas is first compressed to about six hundred pounds, cooled to about 130 degrees below zero (Fahrenheit) by ethylene and ammonia, and then allowed to expand suddenly to a pressure of about three pounds. The sudden expansion in heavily insulated vessels drops the temperature to minus 257 degrees. Storage in well-insulated containers can be effected over long periods of time without building up high pressures; the small quantities of gas which form within the containers during storage are piped off to the distributing system.

Storing Liquefied Gas

The only plant for liquefying, storing and regasifying natural gas, of which I have knowledge, is located in Cleveland, Ohio, and is owned and operated by The East Ohio Gas Company.

This plant was put into operation in 1941 and has been in continuous and successful use since that time. It has a liquefying capacity of 4,000,000 cubic feet of natural gas per day and a regasifying capacity of 70,000,000 cubic feet per day. The capacity of the plant, both for liquefying and regasifying, varies somewhat according to the composition of the gas supplied to it.

The plant consists primarily of (a) apparatus to remove all the moisture and carbon dioxide from the natural gas prior to its liquefaction; (b) six gas engines having a total of 3400 rated horse power, which supplies the power for compressing the natural gas and the ammonia and ethylene that are used as refrigerants; (c) four tanks, well-insulated, for storing the liquid natural gas; and (d) three steam-heated tube-type special heat exchangers which are used to regasify the liquid natural gas as needed.

Three of the storage tanks consist of two concentric spheres, the inner sphere 57 feet in diameter and the outer one 63 feet, the 36-inch space between the inner and outer spheres being filled with cork insulation. Each of these spheres, when full, contain liquid gas which is the equivalent of 50,000,000 cubic feet of natural gas at normal temperatures and pressures. The cubical content of the inner, or holding sphere proper, is 97,000 cubic feet.

The fourth in this series of liquefied

natural gas storage containers consists of two vertical cylinders, one within the other, and equi-distant from it at all points. The inner cylinder has a diameter of 70 feet and a height of 43 feet. The uniform space of 3 feet between the two cylinders is packed with rock wool insulation. This storage holder contains the equivalent of 90,000,000 cubic feet of natural gas at normal temperatures and pressures, and has a cubical content of 176,000 cubic feet.

There must be some free space above the liquid in each container. Hence the equivalent in gas of this plant's total storage capacity can be only approximated as 240,000,000 cubic feet.

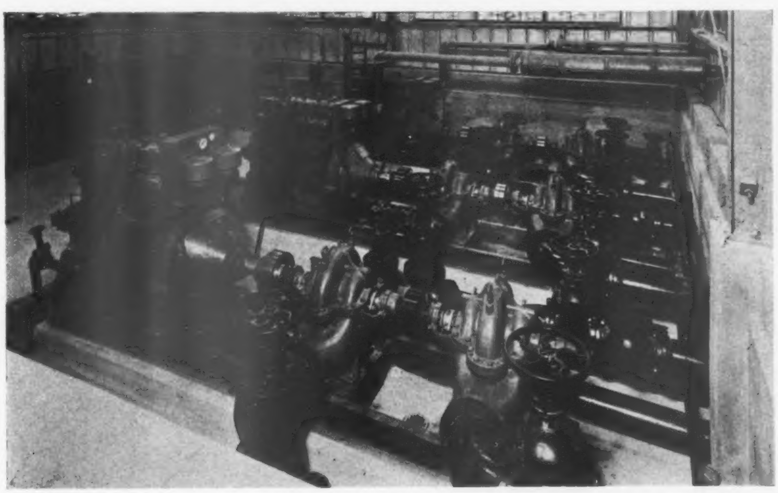
It is interesting to note that it requires considerable heat (20,000,000 B.t.u. per 1,000,000 cubic feet of gas) to return this extremely cold liquid natural gas to its natural and gaseous state. When the plant is regasifying at its maximum rate, 2200 boiler horse power is required to supply sufficient steam for this process.

The cost of the liquid gas plant was $1,700,000, or the equivalent of $7,100 per million cubic feet of storage. The results of its operation to date have been most successful.

From the operating standpoint, liquid natural gas storage may be used to a particularized advantage on a natural gas distribution system. System pressures can be allowed to drop much lower than would be safe operating practice if no liquid natural gas storage were available. This type of storage is particularly valuable for meeting sudden peaks in demand, such as result from very fast drops in atmospheric temperature.

In contrast to liquefied gas storage which, though demonstrated to be successful, is new to the point of novelty,

Gas engine driven centrifugal water pumps at Robinson Station of The East Ohio Gas Co.



Interior view of Robinson Station showing five 600 HP compressor units used to force gas underground or into the distribution system

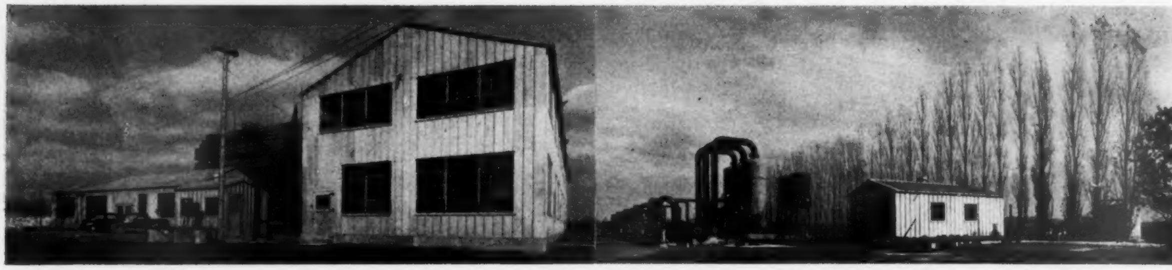
A typical injection well in an underground storage pool

underground storage of natural gas has been practiced for more than twenty-five years. The Menifee Field in Kentucky, and the Zora Field near Buffalo, New York, were the first large fields to be used.

Underground Storage

It is only in the past few years, however, that underground storage of natural gas has been developed into present and fast increasing usefulness. The demands for gas for civilian use and for war industries have increased by leaps and bounds all over the United States, and in many cases the available gas supplies have not been sufficient to meet these demands. In some instances curtailment in delivery has resulted.

This situation is particularly pressing and increasingly critical in the vital industrial areas centering in Cleveland, Pittsburgh and Wheeling. These communities, for the most part, obtain their gas supply from the great Appalachian gas producing area where gas is produced from many horizons, varying in geologic age from the early Pennsylvanian to the Silurian. The natural gas reserves of this region are about six per cent of the total natural



Composite view of Robinson Station, recently constructed unit in East Ohio's underground storage system

gas reserves in the United States, but the users supplied from it consume about sixteen per cent of all the natural gas sold in the United States. The discrepancy between these two figures tells its own story.

The Appalachian fields are fighting a losing battle against depletion, and because of it, and in order to maintain deliveries and service, many of the operating gas companies dependent upon Appalachian supplies, long since found it necessary to establish underground storage areas for seasonal reserves. Their development and extension are accelerating.

Long Distance Transportation

Another factor which has hastened the development of underground storage of natural gas has been the rapid growth of long distance pipe lines. Economy dictates that these lines be operated at full capacity at all times. It has therefore been necessary to provide underground storage in which to accumulate surplus gas from the pipe lines during periods of low demand.

Fifty or more natural gas storage areas are to be found in the United States and Canada. Many of them are located in the Appalachian area, others are in the mid-continent region, in the Pacific coast area and in Canada. These areas vary in size from a few acres to several thousand, and may contain from one billion to many billion cubic feet.

Underground storage areas are usually filled during off-peak periods by one or more of the following practices, sometimes simultaneously:

(a) withdrawing gas from highly competitive areas;
(b) continuously taking gas from a large number of small low-output wells that cannot be turned on and off economically to meet changing demands;
(c) using the surplus capacity of long distance pipe lines.

The following factors are to be considered when selecting and locating an underground storage operation:

1. Location—adjacent to large distributing centers.
2. Size—
   (a) Small, if it is to be used for peak hour and peak day demands; with high rock pressures so that large volumes can be withdrawn in a short time.
   (b) Large, if it is to balance out a system or to balance out the load factor on a long distance pipe line.
3. Type of Reservoir—Size of Wells—
   (a) Porosity of gas bearing stratum.
   (b) Its permeability.
   (c) Freedom from water.
   (d) Structural features, including faults, etc.
   (e) Control of wells and acreage by the operating company.
   (f) Storage rights.
4. Compressor Station Site—
   (a) Available land.
   (b) Accessibility to water.
   (c) Proximity to storage area or areas.
   (d) Nuisance risks involved such as noise and vibration in neighboring communities.
   (e) Transportation—
      1. Employees,
      2. Materials.
   (f) Nearness to main distribution or trunk pipe lines.
   (g) Number of operating wells.
5. Legal—The legal aspects and ramifications of rights covered by an underground storage reservoir are many. Contracts must be negotiated with all well owners and land owners in the area for the rights to repressure gas through the wells into the storage horizon, to store the same, and to withdraw it.

It is important that all of the acreage and wells in an underground storage area be owned or controlled by one operator, or by a single group of operators, so that the entire area can be operated as a unit. If this principle is carried out, no cross-operating is developed and no gas is lost during the storage process.

In a properly selected storage area, there should be no loss of gas during the storage process, whether by migration to uncontrolled areas, or by withdrawals from uncontrolled wells. This can be checked by comparing the amount of gas that must be injected into the area to raise the rock pressures a given amount with the amount of gas that must be withdrawn from the area to reduce the rock pressure the same amount. If the quantity withdrawn is equal to the quantity injected, there has been no loss during storage.

If the selected storage area is near both high pressure (say five hundred pounds per square inch and over) and medium pressure (say one hundred pounds per square inch and under) pipe lines, the area can be filled from the higher pressure line and emptied into the lower pressure line without the use of a compressor station. The practical pressure differential depends upon operating factors.

Use of Compressors

In most cases, however, a compressor station must be built near the storage area to take gas from a feed line and force this gas into the pore space in the gas horizons. Pressures used in this process are in excess of one thousand pounds per square inch.

Some of the best underground storage pools with which I am familiar are located in Pennsylvania, West Virginia, New York and Ohio. Some of the sand horizons used are the Murrysville, the Fifty-Foot, Gantz, Oriskany and the Clinton. Of course, there are many other horizons used for underground storage.

To illustrate the operating conditions of an underground storage operation, I can best use the Chippewa area of The East Ohio Gas Company. The limits of this pool are completely controlled by stratigraphic trapping. Its area covers approximately six thousand acres, has eighteen active wells, and a 1020 H.P. compressor station. Storage

actually began in this pool the latter part of 1941, at which time the rock pressure was 416 pounds. This pressure has been built up to 1,000 pounds, and at this pressure the total amount of gas in storage is 6,000,000,000 cubic feet, which includes 3,250,000,000 cubic feet of gas reserves in the area at the time underground storage started. At the pressures given in the table below, gas can be withdrawn from the area in the following quantities per day:

	cubic feet
1000 pounds pressure	25,000,000
900 pounds	22,000,000
800 pounds	17,000,000
700 pounds	14,000,000
500 pounds	8,000,000
400 pounds	4,000,000

To lower or raise the rock pressure one pound, 12,300,000 cubic feet of gas must be withdrawn from or forced into this storage area. The total cost of this storage area is $1,000,000, including the 3,250,000,000 cubic feet of gas in reserve prior to the time storage was begun.

Coke Oven Gas Underground

It is of interest to note that in the old McKeesport (Pennsylvania), gas field, one of the big steel companies operating in the Pittsburgh district has for a great many years stored coke oven gas in the Speechley sand, pressuring the gas in this underground storage area during week-ends when more gas was produced than could be consumed, and withdrawing it during the week when the demands for fuel exceeded its production.

In conclusion it can be said that each of the four methods of gas storage has its peculiar and particular place in the operation of gas properties. The first three, medium and low pressure storage in holders, and storage of gas in liquid form, perform highly particularized, perhaps narrowly specific functions in maintaining balances between gas supply and consumer demand. But in addition all of them being vital factors in company operating, the full, broad impact of underground storage on the national economy, as well as the natural gas industry, can be judged from the fact that, as of December 1, 1943, the underground gas storage capacity of the areas in the United States now in use for that purpose was 135,000,000,000 cubic feet, with a delivering capacity of 750,000,000 cubic feet a day.

Socially, the potentialities of underground natural gas storage are as great as its economic significance. Perhaps they are the same thing, for great industrial communities, whole chains of industrial communities, have been built up about natural gas deposits, and with a dependence upon natural gas. Depletion is inevitable. You can't burn your gas and have it too. Depletion comes to all natural gas fields, even the greatest. The Appalachian fields are an emphatic illustration of this. Yet natural gas deposits exist in other and distant sections of the country, which are far in excess of local community demands upon them. The relating of these natural gas deposits, with an excess of production capacity, to communities whose millions of people are dependent on diminishing or already inadequate natural gas supplies, can be regarded almost as a social and economic "must."

Long distance pipe lines are the answer, of course—but they are only one part of the answer. Underground storage, strategically located, and adequately calculated for their purpose, are a necessary complement to the transmission lines—almost as necessary to their successful operation as are the fields at one end of them and markets at the other.

The future holds a still greater use for depleted gas fields and their underground storage possibilities. It is not, therefore, in the spirit of prophecy, but only to indicate the way which is clearly ahead of us when I predict that in the not too distant future many of these same natural gas storage pools in the Appalachian area will be used to store manufactured gas, which will be made in the coal fields of West Virginia, Kentucky, Ohio and Pennsylvania, and present pipe line systems, now transporting natural gas, will be used to transport this manufactured gas.

That this may call for a new chemistry of concentrating heat values in more economical volumes of gas than is now commonly practiced in converting coal to gas, I am well aware. But the means and the materials are at hand, and the desirability of this new use for underground gas storage may be no further away than around the corner. Surely in this day of postwar planning they cannot be overlooked.

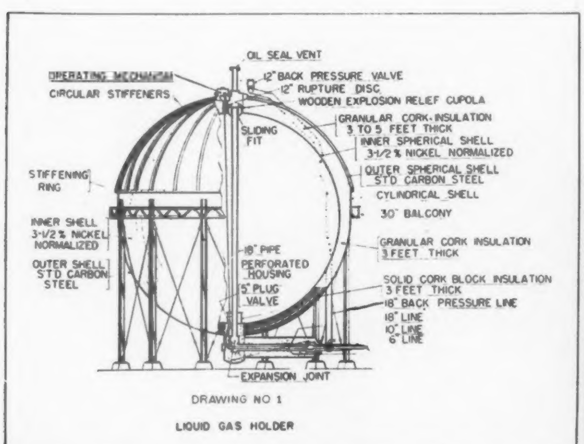


Diagram showing construction of one of the liquid gas holders shown on preceding pages

View of Chippewa repressuring station which is part of East Ohio's underground storage system

A. G. A. Reorganization Approved

Reorganization of the American Gas Association, setting up a Natural Gas Department and a Manufactured Gas Department, has been approved by the membership. Voting on amendments to the Constitution and Bylaws pertaining to the reorganization resulted in 1821 ayes and seven noes. Thirty-eight ballots were incorrectly marked.

Accordingly, the Constitution now provides for a Natural Gas Department and a Manufactured Gas Department, each with a vice-president of the Association as chairman. The vice-presidents will serve as ex-officio members of the Finance and Control Committee.

In accordance with the amendments, J. French Robinson, vice-president of the Association and president of The East Ohio Gas Company, is chairman of the new Natural Gas Department which succeeds the Natural Gas Section of which R. E. Wertz, president, Amarillo Gas Company, Amarillo, Texas was chairman. George S. Hawley, president, The Bridgeport Gas Light Co., Bridgeport, Conn., past president of the Association, is chairman of the Manufactured Gas Department.

Reorganization of various committees of the Association to conform to the new set-up is now under way.

Also approved by the membership was a change in name of the Residential Section to Residential Gas Section.

Program Completed for Technical Conference on Domestic Gas Research

Everett J. Boothby

THE two-day program for the American Gas Association Technical Conference on Domestic Gas Research which will be held in Cleveland, Ohio, Feb. 17 and 18, has been completed and invitations sent to appliance companies inviting them to send members of their engineering staffs to the conference. The conference is being sponsored by the Committee on Domestic Gas Research, Everett J. Boothby, vice-president and general manager, Washington Gas Light Co., chairman, and F. M. Banks, vice-president, Southern California Gas Co., vice-chairman.

The purpose of the conference is primarily to acquaint engineers and other technical men of appliance manufacturers with the technical aspects of the fundamental research sponsored by the committee and which is reported from time to time in the form of research bulletins.

Featured on the program will be technical papers by members of the Association's research staff based on fundamental domestic gas research conducted by the Laboratories during the last few years. Members of the Technical Advisory Subcommittees for the several individual projects will also present papers. Luncheon speakers will be outstanding executives who are familiar with the problems involved in fundamental domestic gas research.

Subjects selected for the programs are:

The Technique of Advancing Atmospheric Gas Burner Design—Mixing Tubes, Burner Ports and Flame Characteristics
The Technique of Advancing Atmospheric Gas Burner Design—Optimum Volume and Noise of Extinction Characteristics
Noise and Heat Transfer Factors in the Design of Gas Heating Appliances
The Relationship of Fundamental Research to Gas Appliance Development
Practical Phases of Fundamental Gas Cooking Research—Top Sections
Practical Phases of Fundamental Gas Cooking Research—Ovens and Broilers
Fundamental Gas Water Heating Research—Efficiency Aspects
Design and Performance Features of Post-War Gas Burners—Aerated Flames
Design and Performance Features of Post-War Gas Burners—Non-aerated Flames
Fundamental Gas Water Heating Research—Combustion Aspects

On Friday afternoon a special feature will be three panel sessions conducted by the three Technical Advisory Subcommittees on gas cooking, gas water heating, and central gas space heating. These panel sessions will discuss problems involved in translating and applying the fundamental research data to help in producing better gas appliances. Luncheons for all those in attendance will be held on Thursday and Friday. Registration will begin at 8:30 A.M., Thursday. Sessions will be held on Cleveland local time which is one hour slower than railroad time.

A. G. A. Testing Laboratories will have an operating exhibit at Hotel Statler during the conference. Certain new ideas concerning burners and burner performance, aeration, ignition, venting, etc., will be included in this exhibit. The Laboratories at 62nd Street will be open also on Saturday morning, February 19, when the staff will be available for consultation by those who have registered at the Research Conference. Inspection of Domestic Gas Research set-up and detail inspection of research data can be made at the Laboratories on Saturday morning.

In cooperation with the Pacific Coast Gas Association, the Committee on Domestic Gas Research will conduct a similar Technical Conference on Domestic Gas Research at the Ambassador Hotel, Los Angeles, California, on March 15 and 16.

The Conference in Cleveland on February 17 and 18 is in charge of the following group representing the Committee on Domestic Gas Research: Eugene D. Milener, conference manager; R. M. Conner; Keith T. Davis; L. R. Mendelson; Paul R. Tappan; William R. Teller; F. E. Vandaveer

West Coast Research Conference in March

THE Ambassador Hotel, Los Angeles, will be the scene of the west coast Technical Conference on Domestic Gas Research on March 15 and 16. This conference, the first of its kind to be held on the Coast, will be sponsored jointly by the Committee on Domestic Gas Research of American Gas Association, Everett J. Boothby, Washington, D. C., chairman; Postwar Appliance Committee of Pacific Coast Gas Association, Harry L. Masser, Los Angeles, Calif., chairman; and Manufacturers Section, Pacific Coast Gas Association, H. A. Sutton, chairman.

The conference will follow the general lines of the February 17 and 18 Research Conference in Cleveland and will be primarily for engineers and designers of appliance manufacturing companies. The fundamental research work sponsored by the Committee on Domestic Gas Research, and which is reported on in the form of technical bulletins, will be the foundation on which most of the papers and presentations will be based. Technical papers will be given by members of the Cleveland and Los Angeles Laboratories' research staffs, by members of the Technical Advisory Subcommittees for the several projects, and by prominent officials of gas companies and appliance manufacturing companies. Demonstrations of research will be given at The Ambassador during the conference and on a more elaborate scale at the Pacific Coast Branch of the American Gas Association Laboratories the morning after the conference closes.

A Gas Heating System for Basementless Houses

H. P. Morehouse

By H. P. Morehouse

Public Service Electric & Gas Co., Newark, N. J.

THE basementless house seems destined to play an important part in postwar housing, partly because it can be built at a lower cost than a house with a regulation basement and partly because it has certain convenience advantages.

In the colder climates, for example in areas where there are over 4,000 degree days per season, it appears that none of the conventional heating systems supply a very satisfactory heating service in basementless houses.

It is hoped that architects, builders, equipment manufacturers and utilities, will give some further thought to this condition before we again embark on the wholesale installation of methods of heating which bring justifiable complaints from home owners.

While all methods of heating, such as gravity warm air, winter air conditioning, steam and hot water systems, have been used in basementless houses the first two mentioned are installed most commonly in the East, using the floor furnace and the vertical forced warm air cabinet unit as the heater.

Just before the war there was a new development in which a horizontal-type heating unit was placed in the attic and the warm air was distributed through a ceiling plenum chamber usually in the top of a central hallway. There was also a new modification of the floor furnace which used a propeller type fan and distributed the air from a plenum built in the bottom of a closet with the plenum located a few inches above the floor.

The greatest heating problem in a basementless house is cold floors. Not only are the houses uncomfortable in cold weather but the method used by the home owner to correct the condition makes for higher operating cost. The owner's only defense is to raise the thermostat setting which of course has the effect of raising his bill about 3% for each degree he raises the temperature. If he must raise the temperature 3° to 5° to be comfortable he may raise his operating cost from 9 to 15%. The owner of this type of home usually cannot afford this extra cost. As a result the family is uncomfortable and gas heat or alleged poor building construction is blamed.

With the conventional heating system the warm air is encouraged to rise immediately to the ceiling and thus it does not warm the floor. In the case of the floor furnace the unit is usually placed in a central hallway. The warm air rises and travels along the ceiling. Through natural convection the cold air comes down the outside walls, windows and doors, and sweeps the floor creating the uncomfortable heating condition pictured in Figure 3. With the conventional cabinet type of winter air conditioner the heat is supplied by high wall registers which blow the warm air across the ceiling toward the outside walls and again help the cold air to travel down the outside walls and across

Figure 1—Gas heater with panel removed

Figure 2—Basementless house heated by gas-fired unit at left

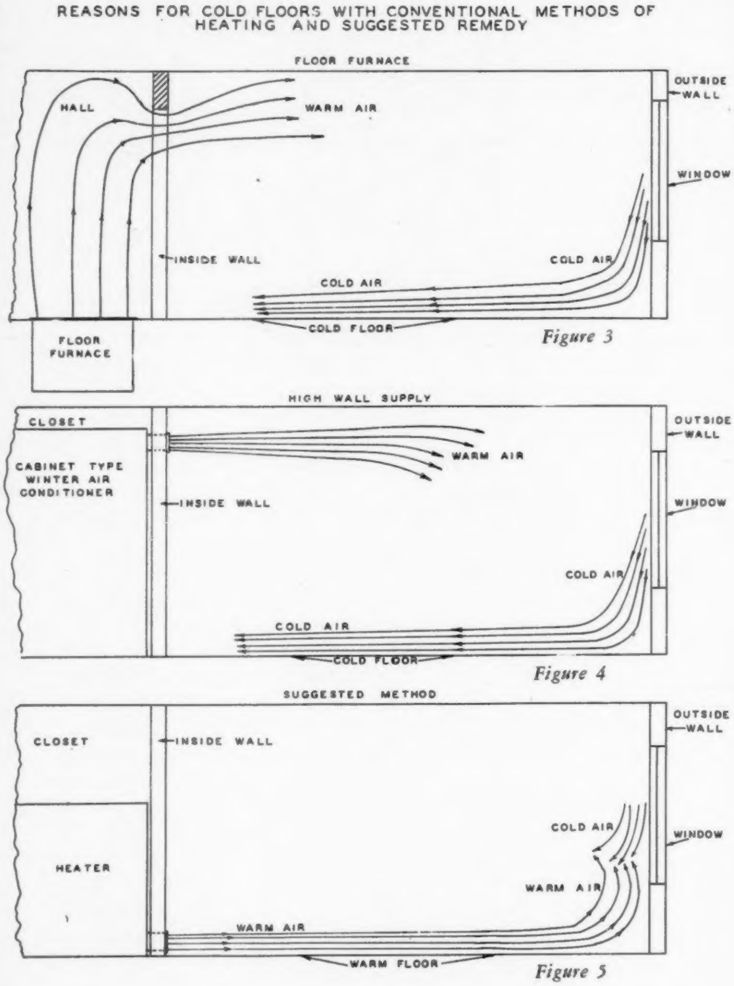


Figure 3

Figure 4

Figure 5

the floor as pictured in Figure 4. Both of these methods encourage drafty conditions.

The servicing arrangements for equipment furnished in the past leave much to be desired. For example, the floor furnace and often the boiler required either a trap door in the floor near the unit, or a partially excavated basement with access to the out-of-doors. In either case servicing was made difficult and the cost of construction was increased.

As an experimental project a heater was designed, built and installed by Public Service in a basementless house near Trenton, N. J. (see Figure 2). The heater, shown in Figure 1 with the service panel removed, has been through two heating seasons and has been found to be very satisfactory. One satisfactory installation does not prove that this is the final and best answer to the problem but it encourages us to believe we are working in the right direction. This house, designed by the Homasote Company, is owned by Mr. and Mrs. E. J. Wargo, Hamilton Township, New Jersey.

It is recognized that a heater design basically different from those on the market is needed to handle the cold floor condition and the difficult servicing conditions. The main factors which should logically influence the design of both the unit and the heating system layout are:

1. The unit and its installation must be so arranged as to correct the cold floor condition.
2. The unit must be readily serviceable from one panel in the living quarters.
3. The unit must be compact.
4. The unit must be quiet in operation as it is installed adjacent to living quarters.
5. The unit must supply positive air circulation preferably by a rotary-type blower.
   Air distribution should not depend upon gravity circulation.
6. The unit must be low in price, commensurate with the price class of the home.
7. The design should be such that the heating layout can be simple in order to keep installation costs low and opportunities for short cuts and chiseling by the installer to a minimum.
8. The arrangement must be flexible enough so that if an upstairs room were finished off, heat could be supplied to it.

The unit built by Public Service incorporates the six equipment features previously mentioned. It is designed on the forced warm air principle. It is not represented as a winter air conditioner. It has no filters or humidifier. These refinements do not seem necessary or desirable on this type of installation for reasons of economy in original cost.

The unit is designed to fit into the bottom of a central hall closet. The arrangement is such that the air is circulated by a blower-type fan in a downward direction through the unit instead of in an upward direction as found in the conventional heating unit. This allows the warm air to be delivered at the floor through long narrow registers equipped with adjustable directional vanes for both horizontal and vertical control.

The bottom edge of the register

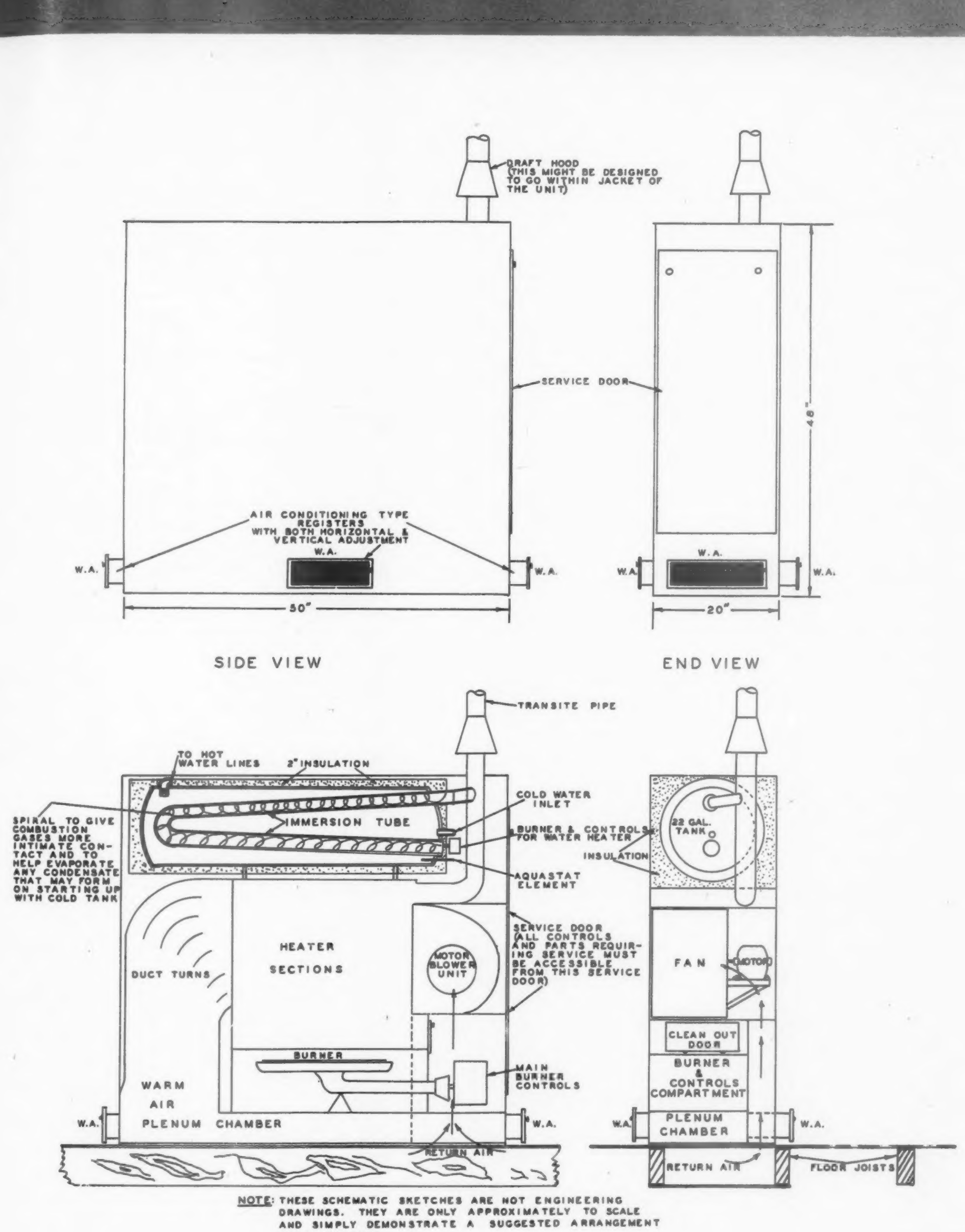

DRAFT HOOD (THIS MIGHT BE DESIGNED TO GO WITHIN JACKET OF THE UNIT)
SERVICE DOOR
AIR CONDITIONING TYPE REGISTERS WITH BOTH HORIZONTAL & VERTICAL ADJUSTMENT
W.A.
W.A.
W.A.
50"
W.A.
W.A.
W.A.
48"
20"
SIDE VIEW
END VIEW
TRANSITE PIPE
TO HOT WATER LINES
2" INSULATION
SPIRAL TO GIVE COMBUSTION GASES MORE INTIMATE CONTACT AND TO HELP EVAPORATE ANY CONDENSATE THAT MAY FORM ON STARTING UP WITH COLD TANK
IMMERSION TUBE
COLD WATER INLET
BURNER & CONTROLS FOR WATER HEATER
AQUASTAT ELEMENT
SERVICE DOOR (ALL CONTROLS AND PARTS REQUIRING SERVICE MUST BE ACCESSIBLE FROM THIS SERVICE DOOR)
HEATER SECTIONS
DUCT TURNS
MOTOR BLOWER UNIT
BURNER
MAIN BURNER CONTROLS
WARM AIR PLENUM CHAMBER
W.A.
W.A.
RETURN AIR
22 GAL. TANK
INSULATION
FAN
MOTOR
CLEAN OUT DOOR
BURNER & CONTROLS COMPARTMENT
PLENUM CHAMBER
W.A.
W.A.
RETURN AIR
FLOOR JOISTS
NOTE: THESE SCHEMATIC SKETCHES ARE NOT ENGINEERING DRAWINGS. THEY ARE ONLY APPROXIMATELY TO SCALE AND SIMPLY DEMONSTRATE A SUGGESTED ARRANGEMENT OF EQUIPMENT.

Figure 6

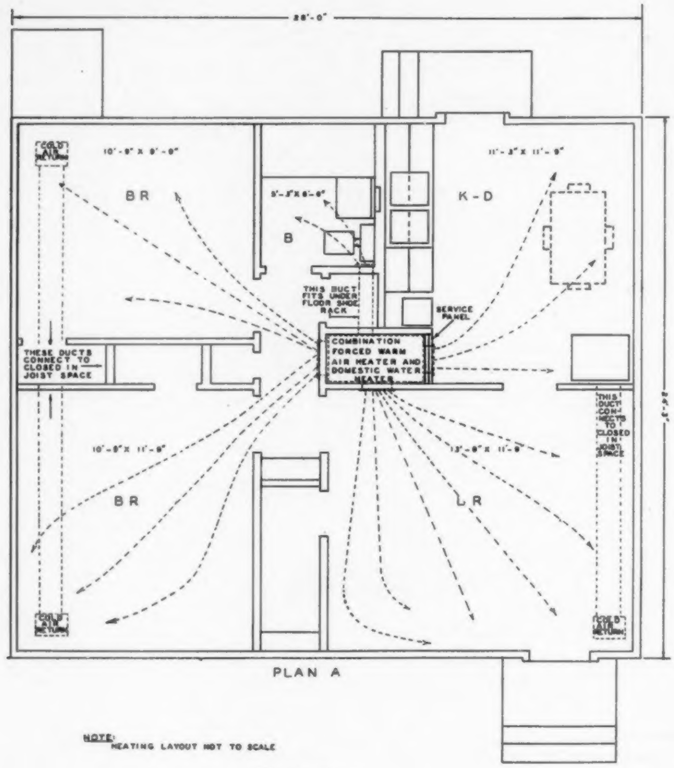


Figure 7

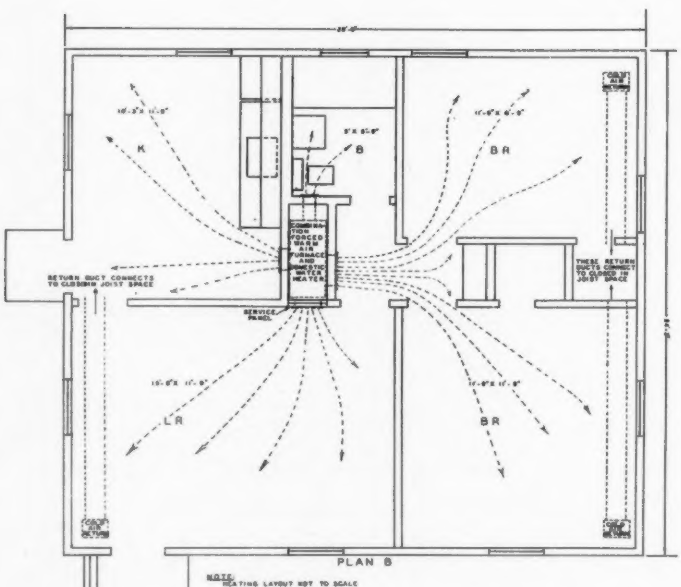


Figure 8

should be at the floor line and not above the baseboard. The importance of this will be obvious by looking at Floor Plan A, Figure 7, where one register takes care of two rooms. It is suggested that the registers be standardized with a vertical height of 4″, which is the smallest commercial size, in order to distribute the air as near to the floor as possible and over as wide an area as possible. It is recommended that the manufacturer of the heating unit also supply the registers because the correct type of register has considerable influence over proper air distribution. The path of the warm air and its effect on the cold air currents with the proposed system is shown in Figure 5.

The unit is so planned that all controls and connections are readily serviceable and the entire unit is removable through one panel. This is very important to the utility company and must receive the most careful consideration by the manufacturer of the unit.

Figure 6 shows in outline a sug-

(Continued on page 94)

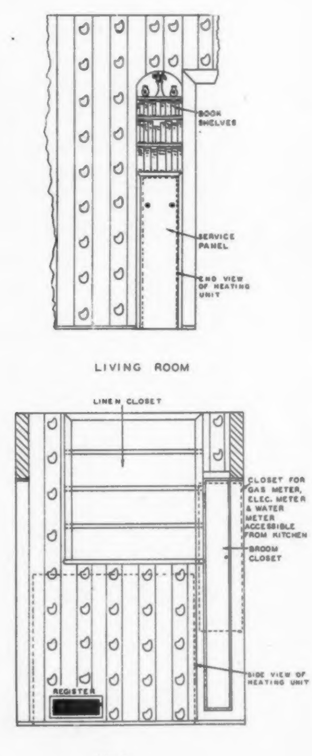
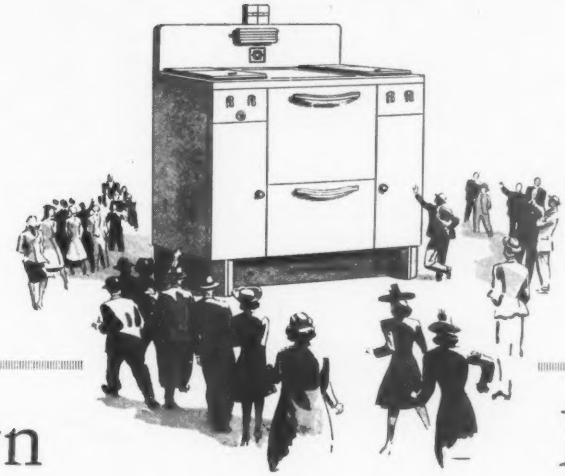


Figure 9



Brooklyn Looks at the Gas Range—*Prewar and Postwar*

By the

New Business Department

The Brooklyn Union Gas Co., Brooklyn, N. Y.

THIS survey was made to "determine the physical condition, the degree of use and operating characteristics of gas appliances and to collect data on wartime relations and thinking of our customers for present and future guidance."

In addition to the information secured, it was felt that the additional customer interviews would be desirable because the number of such interviews has been greatly lessened by:

1. Curtailment of sales calls. These normally amounted to 100,000 visits per year to the homes of our customers.
2. Bi-monthly billing and collecting system.
3. Curtailment of service calls by Distribution Department. In 1942, these were 20% less than in 1941. Based on the 1942 record of range maintenance calls, we are reaching each user of a gas range on the average approximately every seventeen years.

This survey was made to obtain factual information on domestic cooking in the homes of our customers. Fundamentally, the information sought was:

1. Present physical and operating condition of gas ranges now installed.
2. Customer opinions of their gas ranges.
3. Customer thoughts on improvements desired in future ranges.
4. Customer thoughts on our service.

Method

Originally, it was planned to include in the survey an inspection of all domestic gas appliances in the homes visited. As a result of numerous experimental calls, it was found that because of the excessive amount of time required per call, it was desirable to limit the survey to ranges.

As in all such surveys, the soundness of results and conclusions rests to a great extent upon the correctness of the average sample areas selected. Inasmuch as only a small percentage of all customers could be interviewed, care was taken in the selection of representative areas based on types of dwellings, purchasing power and a wide knowledge of the territory.

The questionnaire used was designed to secure two general types of information, namely:

1. Data based on the observations of the interviewer regarding the present range and a record of the adjustment work performed.
2. Reactions and opinions of the customer anent the design of a post-war range.

Because of these two distinct objectives, the recording of information on each objective was kept separately and different survey report forms used to record each. In a great many homes it was possible to obtain information regarding the present range but no worthwhile opinions on the design of postwar ranges. For these reasons and also to simplify presentation and analysis of results, we have considered that two surveys were made. In some homes, both were completed, in others only one.

As a part of the survey, adjustments were made where necessary on all ranges inspected. This free service facilitated the interviewing of customers. The interviewers were given thorough basic training in the making of range adjustments.

At the conclusion of the survey, a letter was sent to five hundred customers who had been interviewed asking their reaction to the visit and whether the operation of their range had improved. Eighty replies were received. These are discussed subsequently in this report.

Coverage and Personnel

Field work was completed on October 29, 1943. The following tabulation indicates the number of each type of questionnaire completed.

Part I regarding present ranges....	6,145
Part II regarding postwar ranges...	3,090
Total:	9,235

A sufficient number of customers was interviewed to arrive at a true average sample. This was indicated by the consistent similarity of data and information secured when analyzing the questionnaires in groups of one thousand.

Presentation of Results

In order to analyze and present definite data from a mass of observations and opinions, it was necessary to frame questions so that answers could be categorically recorded under definite headings. By this method, most of the information secured could be tabulated by our Remington Rand machine equipment. This almost mathematical method of question and answer does not permit of varying shades of opinion. It is, however, the most practical means of classifying mass data of this kind.

White survey questionnaire forms which are designated as Part I, contain the observations of the interviewer on the range and adjustment work performed.

Buff-colored questionnaire form of Part II records the opinions of customers on gas ranges and of some postwar design features. For better visualization, results have been expressed as percentages of the number of interviews, wherever possible.

SUMMARY OF RESULTS
Part I

Age of Range

The estimated average age of all ranges in our territory is between nine and ten years with a probable additional life of seven years. Their physical condition was found to be good, indicating that they will last for any probable war period. Based on the opinions of the interviewers, 18% of all ranges can be considered by normal standards to be in need of replacement.

Insulation

Twenty-nine per cent of all ranges are fully insulated, 25% are semi-insulated, while 46% have no insulation. These figures are not correct for ranges sold in recent years. They are descriptive, however, of ranges now in use by the operation of which the public passes judgment on gas as a cooking fuel.

Condition of Top Burners

Eighty-eight per cent of the ranges inspected had top burners in good or fair condition. However, 59% of the ranges had one or more top burners which were poorly adjusted. In view of the fact that most cooking is done on the top burners, this average poor condition is disquieting.

Top Burner Pilots

Sixty-seven per cent of all ranges have a top burner pilot, indicating a considerable number of very old ranges or ranges from which the pilots were removed. Of those ranges which were pilot equipped, it was found that 23% were not in use and were relighted, and 43% were adjusted.

Size of Range Ovens

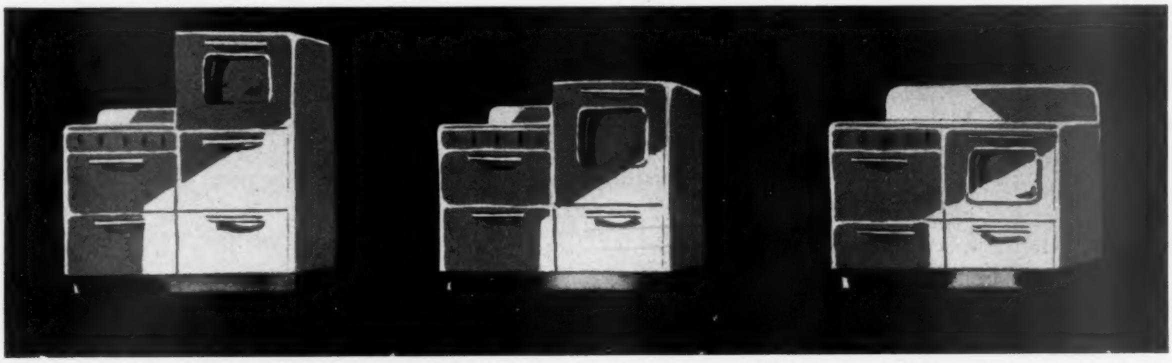
In 93% of the homes visited, the size of the oven was considered satisfactory, indicating that present design is generally correct.

Condition of Oven Linings

A high per cent (88%) of the oven linings were found to be in good or fair condition. The predominating defect in the balance was rusting.

Automatic Oven Pilots

As might be expected, only 3% of the ovens are equipped with automatic means of ignition. Of equal or greater interest is the fact that on 38% of the ovens so equipped, the pilots were found to be operating poorly or were not in use.



Of the three gas range models shown above, Brooklyn housewives chose the one at right by the overwhelming majority of 93 per cent

Broilers

As expected, an overwhelming percentage, namely 92%, do not have a separate broiler burner. All broiler and oven burners appear to be in better condition than top burners. Less than 10% needed adjustment. Since only 35% of the broiler trays were of the smokeless type, a large portion of the people do not enjoy this desirable feature.

Oven Heat Control

Indicative of increasing acceptance of this feature, it was found that 30% of ranges are so equipped. Of these, 25% were found to be inaccurate; some were out of calibration enough to make them of little use.

Steel Wool in Range Flue

We found steel wool had been placed in 7% of the oven flues. This is supposed to reduce the discoloration of the wall and ceiling by removing grease vapors from the oven flue products. This practice is hazardous. We were permitted to remove the steel wool in 77% of these cases.

Shut-off Gas Cock in Kitchen

It was found that in 77% of the homes a shut-off cock had been installed on the gas line supply of the range. Of these, 89% were accessible and therefore readily usable.

Service Work and Repairs

The following figures show in actual numbers the amount of adjustment work performed.

Top burners adjusted (ranges)	3,598
Top pilots adjusted	1,559
Pilots relighted	417
Oven burners adjusted	394
Oven pilots adjusted	11
Oven heat controls adjusted	335
Steel wool removed from flue	321

In two hundred and eighty-five cases customers were referred to the Customers' Service Division or other agencies for parts and service.

The greatest interest in the purpose of the survey and appreciation of the range service work performed were shown by owners and tenants in one- and two-family residences. Tenants in multi-family dwellings showed little interest.

SUMMARY OF RESULTS
Part II

The following presents the more significant findings from Part II of the survey, which records the thoughts and reactions of customers to their present range and new range features. No attempt was made to sell or influence the opinions of persons interviewed on any of the suggested innovations for post-war ranges.

Opinion of Present Range

Eighty-five per cent of the customers expressed satisfaction with their present ranges. Only 15% expressed dissatisfaction. There was no single outstanding reason given. The objections included:

- Lack of heat control
- Difficulty in cleaning
- Smoke from broiling
- Lack of insulation
- Low broiler

Range Top Design

In 92% of the interviews, a preference was expressed for four top burners. It is of interest that almost exactly the same number (91%) have four top burners. Regarding top burner arrangement, 59% prefer the conventional four burners located on the right or left side. The remainder are about evenly divided among other less common layouts. An overwhelming majority, namely 92%, consider that working space on the top of the range is essential.

A built-in electric lamp on top of the range was found in 7% of the homes. Of the customers having ranges so equipped, 32% do not use them.

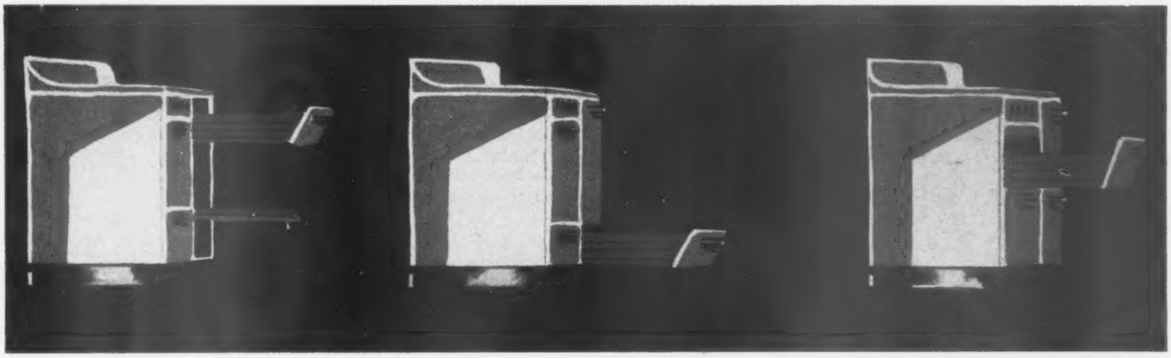
Ovens—location and visibility

Although 93% expressed a preference for a table height oven, there exists an undercurrent of desire, not always forcefully expressed, for a real high oven because of the greater convenience and visibility.

More than half (59%) expressed a desire for a glass panel in the oven door; fifty per cent want an electric light in the oven.

Broilers—use and location

It is generally known that many customers make little use of their broilers. However, when questioned, 70% of our customers stated that they used them considerably. Our observations indicate that the use of the broiler varied widely in different neighborhoods and nationalities. On the question of broiler location, most housewives want the broiler to be as high as possible but not at the expense of lowering the oven or radically changing the appearance of currently accepted styles.



The waist high broiler at right was the favorite, winning 67 per cent of the vote. Model at left scored 10 per cent, other, 17 per cent

CP Ranges

Although there has been no local and very little national advertising on the Certified Performance range in many months, fourteen per cent of the people interviewed were familiar with it. This means that our past efforts to establish this appliance were successful.

Color of Range

Indicative of a trend away from color in range finishes is the high percentage (91%) who prefer white.

Range Features Desired on New Range

	Desirable	*Unnecessary*	*Don't Know*
(A) Automatic oven lighter	46%	26%	28%
(B) Deep well cooker	17	28	55
(C) Automatic timer clock for oven	21	23	56
(D) Automatic timer clock for top burners	16	28	56
(E) Oven heat control	94	3	3
(F) Top griddle	29	45	26
(G) Coverall for top burners	91	5	4

The foregoing indicates a preference for those features which are well known and already have considerable public acceptance. Style and up-to-dateness influence customer opinion at least as much as utility. For instance, coveralls are desired but little used except for special occasions.

Toasting and Coffee Making

The survey shows that eighty-nine per cent use electric toasters, but that ninety-six per cent use gas for coffee making.

Observations

In the course of making this study and as a by-product of the numerous customer interviews, certain observations were made which were outside the formal survey procedure. They were developed at frequent meetings which were held at the conclusion of sampling each neighborhood. These observations are not presented with statistical proof but can be of considerable value in knowing our market. Some of these follow.

1. Many people do not know when a range burner is poorly adjusted. We found burners which were operated with a high, yellow flame for many years.
2. The operation of the oven heat control is widely misunderstood. Women turn it to a high temperature setting under the impression that they get faster heating. Consequently, the oven overheats and inferior cooking results are obtained even though they have reset the control to the desired temperature. This tends to discourage baking and reduces the use of gas.
3. Most new ranges are installed and left operating just as they come from the manufacturer. Unless a request for adjustment service is made by the customer, these ranges operate for years this way. The average customer has no way of knowing whether the burners are adjusted for best results. If their operation is poor, he assumes that gas ranges just work that way.
4. Many, perhaps a majority of our customers, do not think of us in connection with gas range service. The belief is very prevalent that if a range were not purchased from the company, we will not render service. Some are reluctant to call on us for service because they believe a charge will be made.
5. Gas range repair facilities in this area are not adequate. A few widely scattered stores carry a limited stock of repair parts and, in some instances, these agencies are not of a high calibre. Long waits for repair parts are the rule. Our own service in this regard is also slow. As a result, many ranges are operated with broken parts which does not enhance the public's opinion of gas ranges.
6. Many houses in the older sections of our territory require larger house piping before full satisfaction can be obtained from a gas range. In large sections of Williamsburgh, Nassau and Metropolitan branches, ranges are operated on house piping originally installed for gas lights. The kitchen sidearm water heater cannot be used when the range is in operation and the gas pressure drops when more than one range burner is used.

(Continued on page 82)

Ruoff Heads Accident Prevention Committee

George J. Ruoff

GEORGE J. RUOFF, safety engineer, Central Hudson Gas and Electric Corp., Poughkeepsie, N. Y., has been appointed chairman of the Accident Prevention Committee of the American Gas Association, according to an announcement by Ernest R. Acker, president of the Association.

A major objective of the committee this year is to promote the safety of gas industry workers in wartime, a growing task because of the manpower shortage, increased production schedules and over-all emergency conditions. The committee is also concerned with improving the longtime safety record of the industry and sponsors individual and company awards for outstanding accident prevention achievement. Among the later awards are the McCarter Medals, Million-Man-Hour Awards, and A. G. A. Meritorious Service Medal.

A graduate of Rensselaer Polytechnic Institute, Troy, N. Y. in electrical engineering in 1925, Mr. Ruoff is well qualified to head up this important activity. After gaining experience with the General Electric Co. at Pittsfield and Schenectady, and with the Eastern New York Utilities, Rensselaer, he joined the Central Hudson Gas and Electric Corp. in 1928.

During his first five years at Poughkeepsie, he was service supervisor in charge of the construction, operation and maintenance of the gas and electric facilities. From 1934 until the present, with the exception of one year as electric superintendent, he has been safety engineer of the company in charge of the company's accident prevention program. His recent activities have included mapping out extensive personnel and property protection measures and training employees in first aid.

Since November, 1940, Mr. Ruoff has been a part-time special agent in the U. S. Department of Labor serving on the National Committee for the Conservation of Manpower in War Industries.

He is also a member of the Accident Prevention Committee of the Edison Electric Institute.

New Plastic Made From Natural Gas

A NEW, highly versatile plastic, named polythene, has been developed by du-Pont chemists and is now ready for the market in commercial quantities—provided necessary allocations for war purposes can be shown by the processor. It is stated to possess physical qualities that will make it useful in such peacetime employments as toothpaste tubes, wire insulation, waterproof coatings, piping and adhesives. In thin sheets it is flexible without being limp and rubbery, while in thicker shapes it is stiff enough to be classified as a rigid plastic.

Polythene is made by the polymerization, or chemical welding, of large numbers of ethylene molecules. Ethylene is a gas derived from petroleum, natural gas and coal, hence is a cheap, easily obtainable raw material.

Standards Data Issued

AMERICAN Standards Association, 29 West Thirty-Ninth Street, New York City, announced Jan. 3 the publication of its new lists of standards. The booklet includes more than 600 standards, of which sixty-four have been approved or revised since the last list was printed in April, 1943. The standards cover specifications for materials, methods of tests, dimensions, definitions of technical terms, procedures and other related subjects.

Gas Radiant-Tube Heating Speeds War Production

By J. L. Whitten

Vice-President and Sales Manager, Lee Wilson Engineering Co. Inc., Cleveland, Ohio

THE original application of alloy radiant tube heating to bell-type annealing furnaces was made by Lee Wilson in 1934. This principle of heating allowed the use of low-cost fuel gas to produce the same radiant heat application as would be obtainable from any other fuel.

The economy and efficiency of this type of unit immediately became so apparent that the steel mills of the United States devoted to the manufacture of sheet, strip and tinplate in a matter of only a few years entirely abandoned their heavily constructed and inefficient batch-type annealing furnaces and replaced them with bell-type furnaces fired with radiant tubes.

This type of furnace has had a universal spread throughout the sheet and strip industry all over the world so that today there are more than 1500 bell-type furnace units which are fired with radiant tubes that are in daily use for annealing the highest quality sheet and tinplate, narrow strip specialities of all carbon ranges, and rod and wire coils of all analyses.

The bell-type furnace is one in which the furnace can be picked up with a crane and moved from base to base to make one furnace do the work of three, utilizing the heat that is saturated in the lining to be effective in heating up the next charge on the next base on which the furnace is placed.

The charge, of whatever type, is covered by a thin-gauged, lightweight cover, known as an inner cover, which is sealed either in sand or oil, and which acts to retain a special atmosphere around the charge while it is being heated and cooled. There is an inner cover for every base.

The firing tubes in which all combustion takes place are normally made of an alloy which contains 25% chromium and 12% nickel. These tubes are mounted in the side wall of the furnace, as shown in Fig. 1, so that they are fired at the bottom with a burner suitable for the type of fuel used in such manner that the major

Presented before Sixty-Fourth Annual Meeting, American Society of Mechanical Engineers, New York, N. Y., Nov. 29-Dec. 3, 1943.

Figure 1

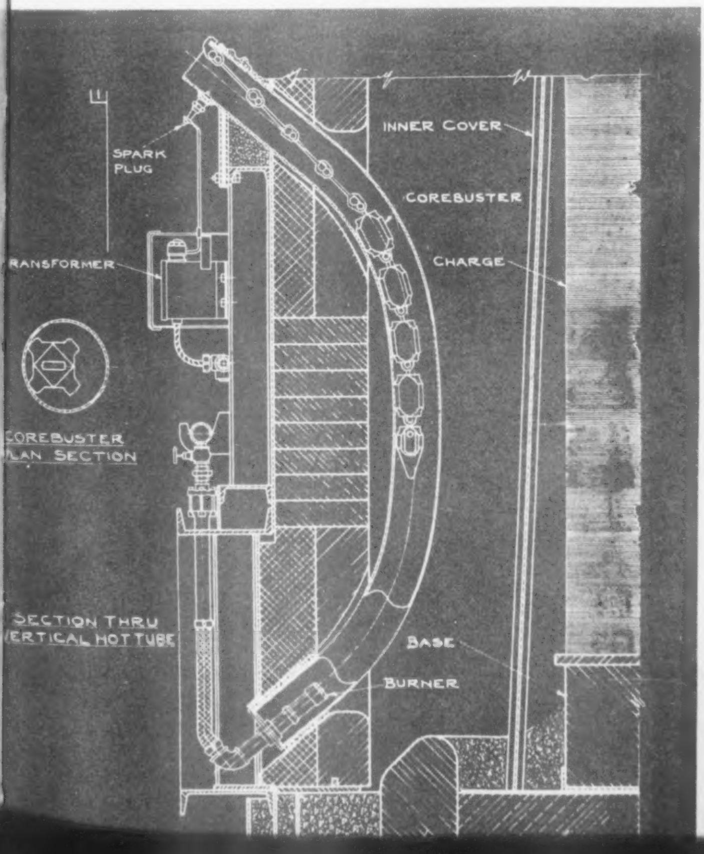


Figure 2

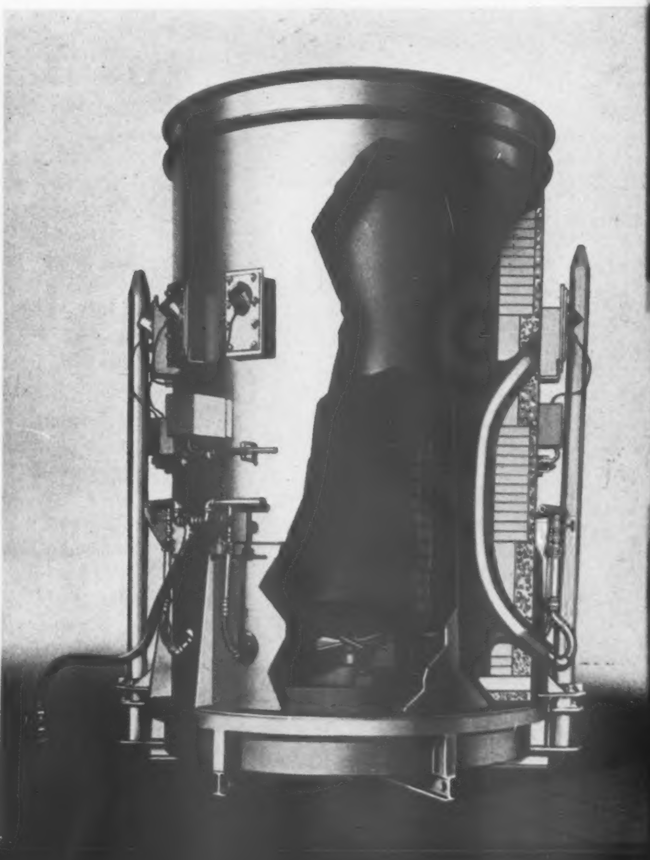


Figure 3

Figure 4

Figure 5

heat release is toward the bottom of the charge.

The products of combustion pass up the tube and out its upper end, to be discharged into the room. Some of their heat is absorbed by the refractory corebuster pieces, shown in position in Fig. 1, which introduced a reradiation surface to make as efficient a use out of the fuel as possible. These corebuster pieces are held in place with alloy links fastened to a hook at the top of the firing tube. The firing tubes are ignited by an electric ignition system which provides a transformer for every two tubes and a high tension transformer for every tube.

When the air and gas travel together up the length of the tube, they strike the electric spark, ignite, and then combustion takes place off the end of the burner and is completed before the gas has reached the lowest corebuster link.

Type of Fuels

The fuels used for radiant-tube firing have been all types of natural and manufactured gases. These include the refinery-developed gases such as propane and butane and low B.t.u. fuels such as anthracite and coke producer gas.

Some installations have been made with vaporized oil in locations where any type of gaseous fuel is not available. There are pressure limitations with oil vapor firing which make it desirable to use gas wherever it is available.

Fig. 2 shows a phantom view of a charge of narrow strip coils in a cylindrical bell-type furnace to indicate just what the relation is between the tubes and the charge. In the cylindrical bell-type furnace or on rectangular furnaces where circular inner covers can be used, such as indicated on Fig. 3, for annealing eight stacks of tinplate coils, a recirculating fan is used at the bottom of each stack so that the gases under the inner cover may be moved rapidly to produce fast heating, fast cooling and extremely high uniformity of temperature distribution throughout the charge.

These fan blades, containing 35% nickel and 15% chromium, are fastened to a shaft of the same alloy, and rotate at 1800 rpm. for 60 cycle current, to produce circulation of 7500 cfm. A large number of tests have been conducted from time to time to determine the efficiency of the fans. In low carbon charges, the heating time is approximately one half of what it would be without fans and for high carbon charges, which involve extremely long time for annealing cycles, the time saving with fans is never less than 20% of the annealing cycle time.

In most cases, centralized panel boards for temperature control are installed to make the installation as flexible as possible. With this system of operation, it is possible to put any furnace on any base in the system and operate it with any temperature control instrument. To do this, the wiring from each base, both thermocouple and temperature control circuits, are run completely back to the centralized panel board. On this board there are a number of plugs and receptacles which allow the operator to select the instrument to work with the furnace on the desired base.

Huge Gas Furnaces in Operation

Some of these bell-type furnace installations are extremely large and involve the expenditure of tremendous sums of money. These expenditures have been made after a thorough check on the soundness of the investment and the performance has fully justified these expenditures. Fig. 4 shows a portion of an installation in one of the Chicago steel districts.

At the Tennessee Coal, Iron and Railroad Company, Birmingham, Alabama, 42 furnaces and 126 bases for annealing tinplate coils are installed. This installation is shown in Fig. 5. In the foreground of the picture it is to be noted how eight cylindrical-type inner covers are used on one base for housing eight stacks of tinplate coils. In these units, the charges weigh 120 tons so that with three bases in operation with each furnace, there is in process usually from 15,000 net tons of tinplate coils at one time.

Fig. 3 shows one of these furnaces lifted in the air while it is being transferred from one base to the other. The furnace weighs 55 tons but it is strong and durable enough

to be handled through years of service without distortion or any indication of lining replacement.

Another type of tinplate annealing furnace which has also been adapted to the use of narrow coils and rod and wire coils is the one shown in Fig. 6 which provides for four stacks of material under four separate inner covers.

In annealing, the heating and cooling of the charge must be done under a protective atmosphere so that the metal will be bright and scale-free when the annealing process is finished. This means that the inner covers must be tight, the sand seals well made and a gas of proper analysis be kept under the inner cover from the time the heat starts until the temperature has cooled down to 250° F. (121° C.) before the charge is uncovered.

Ordinarily this atmosphere is made from partially combusted fuel gas in which the gas is burned with a deficiency of air in the generating unit, similar to that shown in Fig. 7. This unit is a combustion chamber lined with refractories and water-jacketed to dispel the heat generated. The fuel gas and air are pumped up to the proper pressure and measured through orifice plates so that they are introduced in the correct ratio which, for coke oven gas or city gas, is approximately 2½ parts of air to one of gas, and for natural gas, is approximately 6½ parts of air to one of gas.

The products of combustion are then of an analysis of approximately 4½% CO_2, 8 to 10% CO and 10 to 12% hydrogen, with the balance nitrogen. These products are cooled to remove as much of the water vapor as possible and are then passed through a gas refrigerator or a reactivating alumina dryer to reduce their dewpoint to approximately plus 40° F. for ordinary low carbon steel products. For higher carbon steels, gases of different analyses and of much lower dewpoints are required.

After the gas has been cooled or dried, it is then passed on to the bases for use under the inner covers. When this gas is introduced under the inner covers, sufficient time must be taken for purging to drive all of the air out. Otherwise there is danger of an explosion. This purging time will differ in length according to the space left between the charge and the inner cover and also in accordance with the deoxidizing gas pressure. It is considered advisable, in accordance with best practice, to determine the density of the gas leaving the inner covers. When this gas density is equivalent to the gas generated, purging can be said to be complete and then the furnace will be safe to light.

There are available several types of gas testing equipment which give these readings quickly and accurately. Dependence for purging checks should be placed on these instruments rather than the operator's judgment.

For some gases which are especially high in sulphur content, it is desirable to desulphurize the products of combustion by removing SO_2, H_2S from the gas. These products can be removed by circulating the gases through towers which contain wood shavings which have been impregnated with iron oxide and also through towers containing very pure charcoal.

Bell-Type Specialty Jobs

All of the previous discussion has been largely confined to the larger sheet, strip and tinplate mills, but there are a great many installations of radiant-tube-fired bell-type furnaces in the narrow strip cold-rolled specialty mill. For annealing a stack of narrow strip coils, a circular furnace is particularly well fitted Charges of this type usually have a maximum diameter of 48" and a maximum piling height of 84".

In the rod and wire mills, cylindrical bell-type furnaces with radiant tubes predominate.

These wire furnaces are made for all kinds of steel, from ball bearing rod down to the lowest carbon product which is used for screen cloth and other woven wire products.

Many of the wire mills make a large diversity of product so that the gas atmosphere apparatus for annealing must provide suitable atmosphere for all carbon ranges. In the last several years a large number of gas generating installations have been installed for the production of a gas

Figure 6

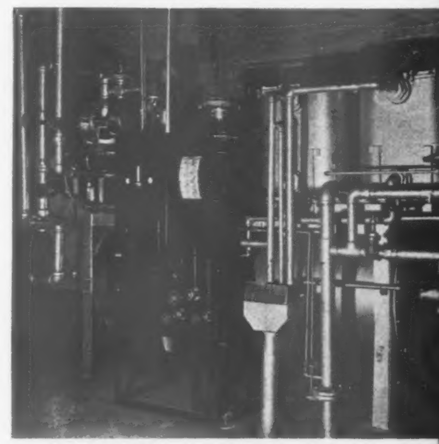


Figure 7

Figure 8

which is 94% nitrogen, 3% CO and 3% hydrogen.

This gas is generated by burning a fuel gas to almost complete combustion in a generator similar to that described before and then removing the CO_2 by chemical absorption. The gas is then dried to a very low dewpoint in a reactivating alumina dryer and is then sent to the bases. Fig. 8 illustrates one of these installations.

The development of the radiant-tube-fired bell-type furnace has not stopped for use with sheet and strip mill and wire mill products. A number of very interesting installations have been made for annealing tool steel bars, seamless pierced tubes and long straight-rolled bars, either cold drawn or hot rolled.

Most of these installations have been made with nitrogen atmosphere generators; and most also have had to be so constructed that a separate hoisting arrangement was required to lift a specially heavy and long furnace up from the charge, as shown in Fig. 9. In these furnaces, charges as high as 20 tons of No. 52100 seamless pierced tubing have been spheroidized; 25 tons of tool steel and 15 to 20 tons of cold rolled bars have been handled at one time.

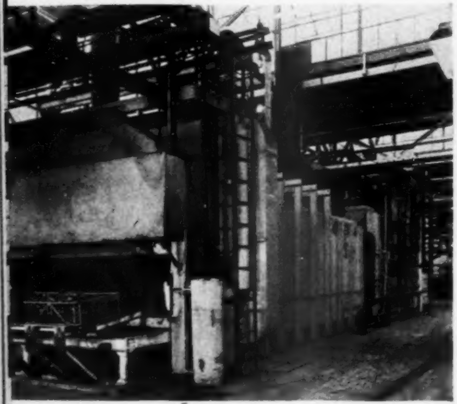


Figure 9

Figure 10

Malleabilizing Adaptation

The most recent development for the use of the radiant-tube-fired bell-type annealing unit is in the malleabilizing of iron castings. A gas tight furnace is used without an inner cover and the charge develops its own atmosphere by the carbon migration from the material. One installation of this type is being made now which will include 19 large rectangular furnaces and 25 bases.

While the great majority of radiant tube installations have been made in bell-type furnaces and while that was the original point of major use, the radiant-tube firing principle has been placed in wide use for almost any kind of furnace in which radiant heat applications have been desired to be used with controlled atmospheres, special atmospheres, or to just keep the products of combustion out of the furnace chamber. In furnaces of this type, the radiation is directly from the firing tubes to the charge, that is, the material does not have to be heated through a muffle or cover. For that reason the temperatures of the tubes are only slightly greater than the temperatures they reach in batch annealing carbon steel products. Ordinarily, these tube temperatures in the continuous furnaces are not above 1650 deg. F., although there are instances where the tubes have been used for applications as high as 1900 deg. F.

The temperature limitations of the tube are much more important than the consideration to be given to the rate of heat dispersion. Generally speaking, a radiant tube which is made from an alloy of 25% chrome, and 12% nickel, is limited in use to a maximum temperature of 1800 deg. F. If the temperatures are to go much higher than this on the tube surface, other materials can be used such as 35% nickel, 15% chrome, and some applications have been made with Inconel as the material from which the tubes were formed. The rate of heat dispersion from a tube will vary entirely with the location of the tube in the furnace and the temperature at the particular point in the furnace where the tube is located.

Ordinarily, the average rate of dispersion from a radiant tube is considered to be 34 B.t.u. per square inch per hour. However, if the tube is located where the heat can be taken away from it rapidly, the rates of dispersion can be much higher, and, of course, if the tube is largely surrounded by furnace brickwork and it cannot radiate freely, the rates of dispersion may be as low as 10 or even 5 B.t.u. per square inch per hour.

The radiant tubes used in bell furnaces, or in other batch-type units, or continuous furnaces, have been made of both cast alloy and also fabricated from alloy strip which is formed into a tube shape and electrically welded. Sometimes the heating tubes are a combination of fabricated portions and castings, depending again on the particular construction required for the application.

Use of Fabricated Tubes

There are cases in which the castings are the easiest type of fabrication to acquire a certain flame path. In general, the author's experience has been more particularly confined to the use of fabricated tubes. They are easier to manufacture and usually can be obtained in much faster time. They can also be adapted to any particular shape or length required from stock material which can be made up into long lengths of standard diameter tubing.

Some discussion is merited about the determination of the wall thickness of the tubing to be used for radiant heating. In the earliest application of radiant tubes, castings were used and they were made as thin as possible to conform with good foundry practice, usually ¼". The thicker the wall of the tubing, the higher the internal temperature of the tube has to be. The fabricated tube could be made out of much thinner material because it is denser, and, of course, it is more practical to achieve the thickness of approximately No. 11 to No. 12 gauge by rolling the material rather than casting it.

By trial and error it was deter-

(Continued on page 94)

Experience with Fully Automatic House Heating Ignition

By T. J. Conway

Superintendent of Service, Minneapolis Gas Light Co.

OUR company now has about 500 gas conversion burners equipped with fully automatic ignition, and these have been on our lines since 1941. The burners are equipped with powerstat automatic pilot lights.

Unfortunately, we have not been able to make a strict segregation of the service calls which these jobs have required and we, therefore, cannot furnish accurate data comparing the results with those obtained from our 21,200 gas heating jobs which do not have fully automatic pilots. We can state, however, that there are fewer service calls and that the customers are pleased with the automatic ignition equipment. We consider it a practical success.

Our operating experience with this equipment may be of interest to other gas companies. Briefly, automatic lighting of gas house heating equipment begins when the room thermostat calls for heat. This starts the cycle of operation of the combination electric coil ignition and powerstat ball valve control. We consider installation of this equipment a big step forward towards good automatic lighting, although some improvements are still needed, such as more durable coils and contacts protected from basement corrosion, dampness, dust, etc. When these are secured there will be further improvements in customer satisfaction and reduced service costs.

No Hazardous Conditions

We would like to call attention to the fact that this equipment either functions or fails to function so that we do not have hazardous conditions to give us concern. Thus, when this type of ignition is in proper adjustment it does a very good job. When it fails, it gives clear evidence of this fact and although this may be a source of complaint, we can consider it an asset that partial failure does not occur.

In its present make-up and application, automatic ignition is an important source of customer satisfaction because customers can operate their heating equipment whenever they want heat. They do not have to depend upon gas company service to start and stop their system.

Sources of trouble with this type of automatic ignition, which necessitate a service call sooner or later, are burned-out ignition coil, lighter cable, or dirty contacts. We find that when heating equipment has not been operating for several months, as during the summer, the contacts are often too corroded or dusty and prevent operation of the ignition source. This is particularly noted at the start of the heating season because the summer conditions in the basements are not too good and the contacts are set horizontal as well as being unprotected so that they are subject to the difficulties which have been described.

We believe that coils should be made of more substantial material for longer life and fewer burn-outs. We also feel that the lighter cable should be better constructed and protected although it is the least cause for service.

The provision for operation during electric current failures is good and does not require relighting of the pilot when the burner is put into operation each time during current failure.

To summarize, we are pleased with this equipment even though we cannot now give complete statistical data on the effect that its use has had upon our company's house heating service costs. About all that we can say is that this type of ignition definitely reduces the number of calls to turn on and off.

Brooklyn Union Drive Under Way To Reduce Home Accidents

Devil Carelessness (Harold F. Coleman) brags with obvious delight that he's more than a match for "dumb, careless humans." But Hero Frederick G. Roberts, right, devises a clever plan and completely outsmarts the villain

• A contribution of the Accident Prevention Committee's "Safety Trends" department, W. T. Rogers, Ebasco Services Inc., New York, N. Y., editor.

THE Brooklyn Union Gas Company is getting behind the drive to reduce home accidents by taking the home safety message to employees. The company's philosophy is that injuries sustained in a home accident are precisely as painful and costly as those suffered on the job, and for that reason the company is trying to reduce all accidents to a minimum.

To emphasize and direct attention to the more common causes of accidents in the home, Brooklyn Union makes use of a skit to dramatize the subject at their regular employee informative meetings. The devil in the skit traps unwary home folk into getting hurt. However, on the scene appears the hero who organizes a safety club which soon overcomes the devil—Carelessness. At the conclusion of the skit, every person in the audience is given a scorecard for use in checking his or her home for potential accident causes.

Company officials state that after the first presentation of the skit and distribution of scorecards, "it was apparent from the manner in which the employees studied the scorecards that many homes were to undergo an inspection that very evening."

The scorecard carried a message from Clifford E. Paige, President of the Brooklyn Union Gas Company, which says in part:

> Accidents are what you make them. They don't just happen. As sure as there is an effect there must be a cause. A moment or a second of carelessness, either mental or physical, may result in a lot of pain or worse.
>
> Think of this for 1942: Our company people had 127 disabling accidents that were non-occupational and 81 disabling injuries in employment. Putting it another way, there were 57% more accidents off the job than there were while at work.
>
> Accidents are among the greatest economic losses of modern times. The economic importance, however, is eclipsed many times by the terrible toll of pain and anguish which accidents cause.
>
> You can help. Will you?

Washington Acclaims . . . *Association's Window and Store Display Bulletin*

WAR BONDS—*By E. C. Deane, Sioux Falls Gas, Sioux Falls, South Dakota*

SALVAGE—*By Robert H. Lewis, Washington Gas Light Company, Washington, D. C.*

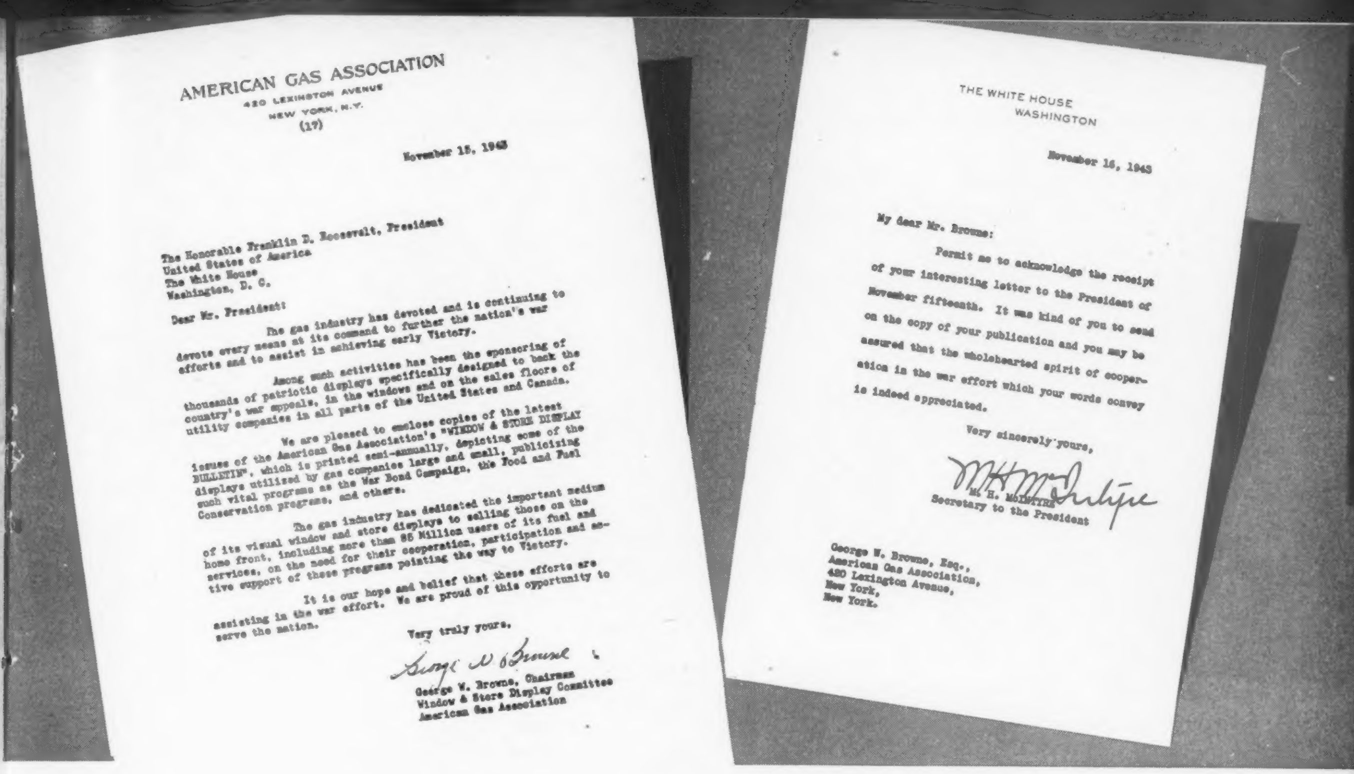
PATRIOTISM—*By H. R. Carlson, The Hartford Gas Company, Hartford, Conn.*

THE value of display advertising has increased tremendously during these two years of war and is headed for an even brighter future.

Government agencies have praised gas utilities and their display men for cooperating in the effort to boost civilian morale by instructing the public in the whys and wherefores of shortages and the need for rationing and conservation. The public's better understanding, more cheerful acceptance of, and cooperation in these matters have greatly accelerated the war program.

In these days of few or no appliances, days with customer contacts reduced to a minimum, window and floor displays have a vitally important job to do. The job of telling how the gas industry is helping to win the war, the job of promoting confidence in our public utility system.

Therefore, the Window and Store Display Committee under the chairmanship of George W. Browne, Public Service Electric and Gas Company, Newark, N. J., has planned during 1944 to supplement the Bulletin with a news letter that will keep the gas utility displaymen informed on items of interest to them including material



AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE
NEW YORK, N.Y.
(17)

November 15, 1943

The Honorable Franklin D. Roosevelt, President
United States of America
The White House
Washington, D. C.

Dear Mr. President:

The gas industry has devoted and is continuing to devote every means at its command to further the nation's war efforts and to assist in achieving early Victory.

Among such activities has been the sponsoring of thousands of patriotic displays specifically designed to back the country's war appeals, in the windows and on the sales floors of utility companies in all parts of the United States and Canada.

We are pleased to enclose copies of the latest issues of the American Gas Association's "WINDOW & STORE DISPLAY BULLETIN", which is printed semi-annually, depicting some of the displays utilized by gas companies large and small, publicizing such vital programs as the War Bond Campaign, the Food and Fuel Conservation programs, and others.

The gas industry has dedicated the important medium of its visual window and store displays to selling those on the home front, including more than 85 Million users of its fuel and services, on the need for their cooperation, participation and active support of these programs pointing the way to Victory.

It is our hope and belief that these efforts are assisting in the war effort. We are proud of this opportunity to serve the nation.

Very truly yours,

George W. Browne

George W. Browne, Chairman
Window & Store Display Committee
American Gas Association

THE WHITE HOUSE
WASHINGTON

November 16, 1943

My dear Mr. Browne:

Permit me to acknowledge the receipt of your interesting letter to the President of November fifteenth. It was kind of you to send on the copy of your publication and you may be assured that the wholehearted spirit of cooperation in the war effort which your words convey is indeed appreciated.

Very sincerely yours,

M. H. McIntyre

M. H. McINTYRE
Secretary to the President

George W. Browne, Esq.,
American Gas Association,
420 Lexington Avenue,
New York,
New York.

CONSERVATION—*By. T. J. Taylor, The Philadelphia Gas Works Company, Philadelphia, Pa.*

available from government agencies, gas appliance manufacturers and poster service publishers.

During the past year, two display bulletins were published which emphasized government cooperation, gas as an aid to war production, and post-war preparation. The number of utilities that contributed material increased 25%. In addition, requests were answered, from utilities in Canada and Australia, for information pertaining to displays on fuel conservation and other government-requested themes.

TREASURY DEPARTMENT

We wish to take this opportunity to tell you what a splendid job you are doing in your Association. Your Bulletins, we are sure, will inspire many displays for such vital programs as ours during the coming year.

W. RICHARD HARVEY

SALVAGE DIVISION WPB

May I take this opportunity to congratulate the American Gas Association for the outstanding contribution they have made to the war effort through the very attractive and effective window displays. I want to extend the thanks of the salvage division for the work that you have already done and to express the hope that this work will be continued.

F. M. FAUST

UNITED SERVICE ORGANIZATIONS, INC.

The gas industry may be rightfully proud of its generous cooperation, participation, and active support of the various war-related programs. We in USO are particularly appreciative of your efforts in our behalf.

CHESTER I. BARNARD

OFFICE OF CIVILIAN DEFENSE

Efforts like the ones depicted in the Bulletins of the American Gas Association will help to keep the civilian population of our country aware of the ever-increasing need of total participation in the war effort.

May I take this opportunity to congratulate you on the effectiveness and excellence of your displays.

JOHN B. MARTIN

WAR ADVERTISING COUNCIL, INC.

The point-of-sale medium represents a large measure of the advertising power that must be harnessed if the people of the nation are to receive the information they need to guide them in their wartime actions. It is gratifying to see how effectively the gas industry has mobilized this advertising medium

IRWIN ROBINSON

OFFICE OF WPB CHAIRMAN

Mr. Nelson was very much interested in looking over the displays and appreciates the splendid cooperation which the gas industry has given to the various conservation programs of the War Production Board.

IONA THORNTON

Personal AND OTHERWISE

Lone Star Executive Changes

R. G. Soper

SEVERAL changes among executives of Lone Star Gas Company, Dallas, Texas, have been announced by D. A. Hulcy, president of the company.

Richard G. Soper retired as vice-president of Lone Star and general manager of its Dallas Division effective January 1. Mr. Soper had been with the company 35 years, going to Dallas from Detroit. During his term of service the Dallas Division grew from less than 6,000 meters to 95,000.

C. L. May

Chester L. May, a vice-president of Lone Star who is known throughout the gas industry, was promoted to have general supervision of all distribution properties of the system, including Dallas and Fort Worth. The company serves about 300 towns and cities in Texas and southern Oklahoma. Mr. May was born in Lima, Ohio, and has been with Lone Star since January, 1917. He has worked up through every phase of the business, and in the period 1925 to 1929 supervised the construction of more than 200 town plants.

Wesley F. Wright, who has been operating manager of the Dallas Division under Mr. Soper, was promoted to succeed him as general manager of the division. He was born in Sullivan, Indiana, and joined the Dallas Gas Company in December, 1911, shortly after natural gas was turned into the mains. He has held membership on a number of American Gas Association committees.

Floyd L. Carmichall was appointed general manager of the Forth Worth Division of Lone Star. Since Sept. 1, 1933, he has been operating manager of this division. He has seen service also with both the Dallas Gas Company and the former Community Natural Gas Company. He took a civil engineering course at Purdue University in Indiana.

The reorganization places the two principal departments of the Lone Star system under unified management. Elmer F. Schmidt, vice-president, is in charge of the gathering and transmission system and related activities, and Mr. May, the other vice president, has charge of the distribution properties, all under President Hulcy.

Roth Advanced

E. E. ROTH, chief geologist of the Columbia Gas & Electric Corporation, was elected vice-president of United Fuel Gas Company, a subsidiary of Columbia, at a meeting of the board of directors January 5, it was announced by Harry A. Wallace, Jr., president of the United Fuel Gas Company.

Strickler Nominated for U.S. Chamber Board

T. J. Strickler

T. J. STRICKLER, vice-president and general manager of the Kansas City Gas Company, has been unanimously nominated by the Board of Directors of the Kansas City, Missouri, Chamber of Commerce for reelection to the Board of Directors of the United States Chamber of Commerce.

A past president of the American Gas Association, Major Strickler is nominated to represent the 7th election district, which includes the states of Missouri, Kansas, Arkansas, Louisiana, Oklahoma, and Texas.

The Kansas City, Missouri, Chamber of Commerce has sent his nominating petition to all member organizations in the above states. His election, however, will be subject to the vote of all councilors in the United States representing such member trade associations as the American Gas Association, as well as all Chambers of Commerce. The election will take place at the annual meeting of the United States Chamber of Commerce early in May.

Gas Man Honored for Life Saving

EDWARD CASLANDER, draftsman, gas distribution department, Public Service Electric and Gas Co., Paterson, N. J., recently was awarded a McCarter medal for his outstanding achievement in reviving a person overcome by gas. The medal is awarded by the American Gas Association on recommendation of the Accident Prevention Committee and is given only for successful resuscitations performed by the Schafer prone pressure method.

The presentation to Mr. Caslander was made December 8 by Frederick A. Lydecker, general superintendent, gas distribution. A certificate of assistance was presented to Edward Cosgrove, fitter in the Paterson distribution department.

In making the presentation, Mr. Lydecker said that 67 McCarter medals, four bars, 21 certificates of assistance and one certificate of recognition have been awarded to Public Service employees since 1923 when the award was established by Thomas N. McCarter, chairman of the board of Public Service Corporation of N. J.

McCarter medal presentation—Left to right, center foreground: L. Martin Harris, Edward Cosgrove, F. A. Lydecker, Edward Caslander, and John M. Orts

Koppers Vice-President

George M. Carvlin

ELECTION of George M. Carvlin as a vice-president of Koppers Company, Engineering and Construction division, has been announced by J. P. Williams, Jr., president.

Mr. Carvlin had been an assistant to Joseph Becker, vice-president of Koppers Company and general manager of the division, since 1940. He started with Koppers as a research engineer in 1925, later serving in the operating and sales departments.

Smith Retires, Stackpole Made Sales Manager

DORSEY R. SMITH, manager, merchandising and domestic gas and electric sales, of the Consolidated Gas Electric Light and Power Company of Baltimore, has retired after 40 years of service. He has been succeeded by Chester S. Stackpole, who has been assistant manager since 1928.

Mr. Stackpole is chairman of the Water Heating Committee of the Residential Gas Section, American Gas Association.

Utility Board Reduced

STUART M. CROCKER, president of Columbia Gas and Electric Corporation, announced Jan. 6 that the board of directors of the company had been reduced to ten and that five members had resigned, having found it increasingly difficult to attend meetings and perform other duties as directors because of restricted travel accommodations.

Those resigning are Harry J. Crawford, Thomas B. Gregory, Henry N. Mallon, John G. Pew and Thomas W. Phillips Jr. All except Mr. Mallon have been identified with the Columbia Gas Company since its organization in 1926.

Elected President of Indiana Chamber

DEAN H. MITCHELL, president, Northern Indiana Public Service Company, Hammond, has been elected president of the Indiana State Chamber of Commerce. Mr. Mitchell who was first vice-president of the Chamber succeeds Louis Ruthenburg, president of Servel Inc., who was last year's president.

Mr. Mitchell has been active in both state and national civic associations. He was Chairman of the Association's Accounting Section in 1938 and is a member of the Association's Committee on National Advertising.

Gas Research Program Forges Ahead

Scene during a recent meeting of Technical Advisory Subcommittee for Domestic Gas Research Project No. 6 on Central Space Heating. William R. Teller, chief research engineer of the A. G. A. Testing Laboratories is discussing the elements of noise production in atmospheric gas burners. At this meeting, which was presided over by Chairman Keith T. Davis, recently completed parts of the fundamental research work in furnace noises and heat transfer were thoroughly reviewed and the working outline for the project was adjusted for the first part of 1944.

Clifford E. Paige Cited as Man of Year in Brooklyn Borough

Clifford E. Paige

HENRY J. DAVENPORT, president of the Downtown Brooklyn Association, announced last month that Clifford E. Paige, president of The Brooklyn Union Gas Co., has been awarded the association's gold medal. This medal is presented annually to the citizen who has rendered the "most distinguished service for Brooklyn" during the year.

Mr. Paige was awarded this honor partly as a result of his splendid and inspiring leadership of the King's County War Finance Committee which organized and directed the greatest financing operation in Brooklyn's history.

The medal was presented to Mr. Paige at the annual luncheon meeting of the association held at the Bossert Hotel on January 25. The luncheon was attended by many prominent officials and citizens identified with the borough's civic, philanthropic and business life. Guest speaker at this meeting was Colonel Willard Chevalier, publisher of *Business Week* and regional vice-chairman for the New York area of the National Committee for Economic Development.

Mr. Paige has been active on the boards of many civic, philanthropic and business organizations. Among these are the American Red Cross, the Brooklyn Hospital, Boy Scouts of America, St. Christopher's Hospital for Babies, Brooklyn Polytechnic Institute, Brooklyn Foundation, Inc., Brooklyn Institute of Arts and Sciences, Long Island College of Medicine, National Safety Council, New York City Council for Defense, and USO.

He is at present on the boards of the following: Downtown Brooklyn Association, Brooklyn Chamber of Commerce, Society for the Prevention of Cruelty to Children, the Salvation Army, Queens Chamber of Commerce, Mayor LaGuardia's Business Advisory Committee, Brooklyn Trust Company, Brooklyn City Safe Deposit Company, South Brooklyn Savings Bank and Greater New York Safety Council.

These are all in addition to his utility activities which continued over many years in New England before his coming to Brooklyn. He is said to be the only man who has been president of all of the following: American Gas Association, New England Gas Association, Empire State Gas and Electric Association and the Guild of Gas Managers. He was also vice-president of International Gas Union and Electric and Gas Association of New York.

At present in addition to his duties as a utilities' executive, and as chairman of the Kings County War Finance Committee, he is serving as chairman of the Brooklyn Chamber of Commerce's committee on post-war management problems.

Oklahoma Utilities Elect Officers

E. C. JOULLIAN, president, Consolidated Gas Utilities Corp., Oklahoma City, has been elected president of the Oklahoma Utilities Association for the 1944 term.

Other new officers are: first vice-president—George M. McLean, Oklahoma City Gas and Electric Co.; second vice-president —A. F. Potter, The Gas Service Co., Bartlesville; treasurer—D. S. Kennedy, Oklahoma Gas and Electric Co.; secretary—Kate A. Niblack, 626 Biltmore Hotel, Oklahoma City (re-elected).

New England Gas Annual Meeting

THE annual meeting of the New England Gas Association will be held Thursday, March 23, at the Hotel Statler, Boston, Mass. It will consist of two general business sessions instead of the customary two-day function held in peacetime.

Pennsylvania Gas News Letter

W. G. B. WOODRING, president, Pennsylvania Gas Association, on January 10 announced the inauguration of a P. G. A. News Letter to keep members informed of the Association's activities.

The news letter will be distributed periodically under the direction of R. C. Cox, as editor, and William Naile, secretary of the Association, with the assistance and support of the chairmen of committees.

Pacific Coast Gas Proceedings Out

PROCEEDINGS of the fiftieth annual meeting of the Pacific Coast Gas Association were recently published. Making up 136 printed pages, 8½ by 11 inches in size, the volume carries a complete report of the sessions held Sept. 22, 1943 at the Ambassador Hotel. It includes addresses, papers and reports presented at the business sessions, Accounting, Manufacturing, Sales & Advertising, and Technical Sections.

CONVENTION CALENDAR

1944

FEBRUARY

Feb. 17-18 American Gas Association Technical Conference on Domestic Gas Research
Hotel Statler, Cleveland, Ohio

MARCH

Mar. 6-7 Southern Safety Conference
Atlanta, Ga.

15-16 West Coast Technical Conference on Domestic Gas Research
Ambassador Hotel, Los Angeles, Calif.

22-23 Southern Gas Association Annual Meeting
Roosevelt Hotel, New Orleans, La.

23 New England Gas Association Annual Meeting
Hotel Statler, Boston, Mass.

30-31 1944 American Gas Association War Conference on Industrial and Commercial Gas
Hotel Seneca, Rochester, N. Y.

APRIL

Apr. 3-5 American Society of Mechanical Engineers
Birmingham, Ala.

10-12 National Association of Corrosion Engineers
Rice Hotel, Houston, Texas

18-19 American Gas Association Distribution Conference
Hotel Statler, Cleveland, Ohio

19-20 Missouri Association of Public Utilities
St. Louis, Mo.

MAY

May 2 Pennsylvania Gas Association Annual Meeting
Philadelphia, Pa.

8-11 National Fire Protection Association
Philadelphia, Pa.

15-18 Natural Metal Trades Association
Hotel Biltmore, New York

JUNE

June 6-7 American Gas Association Joint Production and Chemical Committee Conference
Hotel Pennsylvania, New York, N. Y.

June 6-8 Public Utilities Advertising Association
Palmer House, Chicago

6-8 Southwestern Gas Measurement Short Course
University of Oklahoma, Norman, Okla.

19-22 American Society of Mechanical Engineers
Pittsburgh, Pa.

Oct. 3-5 National Safety Congress
Sherman, Morrison & La-Salle Hotels, Chicago, Ill.

Victor A. Ogilvie Dies

VICTOR A. OGILVIE, director and assistant treasurer of Gas Advisers, Inc., died at his home in Ridgewood, New Jersey, on January 9, after an illness of three months.

Mr. Ogilvie has been connected with the Cities Service Company system for twenty-five years, beginning his career, upon graduating from Iowa State College in 1917, as an engineer with the Denver Gas and Electric Light Co. in Denver. After serving overseas with the Army Engineers in the World War, he continued his work with the Denver company until March, 1920.

He was next employed as engineer in the Gas Distribution Department of the Empire Companies with headquarters in Bartlesville, Oklahoma. In January, 1925 he was made Chief Engineer of Dominion Natural Gas Company, Ltd. and Republic Light, Heat & Power Company with headquarters at Buffalo, New York, and continued in this capacity until January, 1931.

For the past thirteen years, Mr. Ogilvie has been located in New York doing work relating to all phases of gas engineering for natural gas and natural gasolene properties located in Colorado, Texas, Oklahoma, Louisiana, Kansas, Arkansas, Missouri and New York. From October to December, 1941 he served as a member of the staff of the Priorities Section of the Power Branch of the Office of Production Management at Washington, D. C., on a dollar-a-year basis.

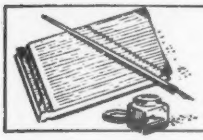
Mr. Ogilvie was an active member of the American Gas Association for many years, was a member of the Wrinkle Committee since 1935 and was Chairman in 1941 and 1942

Otto Goldkamp Dies

IN the death last month of Otto Goldkamp, gas meter department superintendent for the San Diego Gas and Electric Company, the nation's gas industry lost one of its ablest, most original and inventive meter men. His inventions in the fields of gas pressure regulation, and in the accurate measurement of gas flow gained for him an international reputation.

In 1937 Mr. Goldkamp was awarded the Pacific Coast Gas Association's Basford Trophy for outstanding achievement, a recognition few individuals have been accorded.

All of his devices are used extensively in the meters and distribution system of the local gas utility as well as throughout the entire United States. They include a variety of appliances for the repairing and testing of gas meters, a combination meter and regulator (the only type of its kind in existence), a compounding regulator for the more constant control of gas pressure in connection with branch feeders from main high pressure transmission lines, as well as several straining devices for the screening of dust particles, thus permitting the free flow of gas to pilot lights and other extremely small burner openings.



Accounting SECTION

O. H. RITENOUR, *Chairman*
C. E. PACKMAN, *Vice-Chairman*
O. W. BREWER, *Secretary*

What Are the Rules?

By C. E. PACKMAN*

General Auditor, Middle West Services Co., Chicago, Ill.

C. E. Packman

ONE definition of pragmatism, credited by Mr. George O. May[1] to Professor Josiah Royce, is "the philosophy according to which you can change your mind as often as you like and are always right." Mr. May observed that this seemed to be the ground on which it had become the fashion of some commissions to justify changes in the rules in the middle of a performance. He was talking about a change in the rules with respect to depreciation accounting. But the observation, in the opinion of this writer, is equally apt in connection with the treatment being accorded by some commissions to intangible costs.

In 1936 in the American Telephone & Telegraph Company case[2] the Supreme Court apparently said that no system of accounts promulgated by regulatory authority should contain a mandatory requirement that the difference between original and present cost must be written off. In that case appellants were objecting to a provision in "Telephone Plant Acquisition Adjustment," account 100.4, in a new system of accounts prescribed by the Federal Communications Commission to the effect that:

> "the amounts recorded in this account with respect to each property acquisition shall be disposed of, written off, or provision shall be made for the amortization thereof in such manner as this Commission may direct."

There does not seem to be any ambiguity in the meaning of these words which apparently required the disposition of the amounts in question. But the Court said that that was not its meaning according to the evidence. It said:

> "The argument is that account 100.4, representing the difference between original and present cost is not to be reckoned, either wholly or in part, as a statement of existing assets, but must be written off completely. The Commission is charged, we are told, with a mandatory duty to extinguish the entire balance recorded in that account."
>
> "If subdivision (C) had the meaning thus imputed to it, there would be force in the contention that the effect of the order is to distort in an arbitrary fashion the value of the assets. But the imputed meaning is not the true one. The Commission is not under a duty to write off the whole or any part of the balance in 100.4 if the difference between original and present cost is a true increment of value. On the contrary, only such amount will be written off as appears, upon an application for appropriate directions, to be a fictitious or paper increment. This is made clear, if it might otherwise be doubtful, by administrative construction. Thus, the Commission's chief-accountant testified that by the proper interpretation of account 100.4, amounts therein—
>
> > 'would be disposed of, after the character of the item had been determined, in a manner consistent with the general rules underlying the uniform system of accounts for the distribution of expenditures, according to their character, to operating expenses, income, surplus, *or remain an investment.*'"

The Court said that other witnesses gave testimony in substance to the same effect. But it said that even more decisive was the statement made by counsel for the Government when, to avoid the chance of misunderstanding and to give adequate assurance to the companies as to the practice to be followed, it requested the Assistant Attorney General to reduce his statements in that regard to writing in behalf of the Commission. He did so and said that:

> "The Federal Communications Commission construes the provisions . . . . as meaning that amounts included in account 100.4 that are deemed, after a fair consideration of all the circumstances, to represent an investment which the accounting company has made in assets of continuing value will be retained in that account until such assets cease to exist or are retired; and in accordance with paragraph (C) of account 100.4, provision will be made for their amortization."

The Court said:

> "We accept this declaration as an administrative construction binding upon the Commission in its future dealings with the companies. . . . . The administrative construction now affixed to the contested order devitalizes the objection that the difference between present value and original cost is withdrawn from recognition as a legitimate investment."
>
> "We are not impressed by the argument that the Classification is to be viewed as arbitrary because the fate of any item, its ultimate disposition, remains in some degree uncertain until the Commission has given particular directions with reference thereto. By being included in the adjustment account, it is classified as provisionally a true investment, subject to be taken out of that account and given a different character if investigation by the Commission shows it to be deserving of that treatment. Such a reservation does not amount to a departure from the statutory power to fix the forms of accounts for "classes" of carriers rather than for individuals. The forms of the accounts *are* fixed, and fixed by regulations of adequate generality. What disposition of their content may afterwards be suitable upon discovery that particular items have been carried at an excessive figure must depend upon evidentiary circumstances, difficult to define or catalogue in advance of the event. If once there was any need for explanation more precise than that afforded by the order, it is now supplied, we think, by an administrative construction, which must be read into the order as supplementary thereto."

Classification of Accounts

In 1936 the Federal Power Commission promulgated a system of accounts for electric utilities and shortly thereafter the National Association of Railroad and Utilities Commissioners adopted systems of accounts for electric and gas utilities containing account 100.5—Plant Acquisition Adjustments—which provides as follows:

> "The amounts recorded in this account with respect to each property acquisition, shall be depreciated, amortized, or otherwise disposed of, as the Commission may approve or direct."

In April, 1941, the Securities and Exchange Commission adopted its Rule U-27 which provides that any public utility company which is not required by either the FPC or a state commission to conform to a classification of accounts shall keep its accounts, in so far as it is an electric utility according to the FPC system of accounts, and in so far as it is a gas utility accord-

* Vice-Chairman, Accounting Section.

ing to the system of accounts adopted by the NARUC.

The language in the systems of accounts of the FPC and the NARUC is not substantially different from that with which the Court was dealing in the American Telephone & Telegraph case, but there is no evidence that either the FPC or the SEC feel that they are bound by any of the limitations imposed by the Court in that case. In fact, the FPC offers that case as justification for some of its requirements. For example, in St. Croix Falls Minnesota Improvement Co.[3] it said:

"except for fictitious or paper increments, which should be charged off at once, (American Telephone & Telegraph Co. v. United States 299 U. S. 232, 240) provision in advance of retirement should be made."

What the Court said about "fictitious or paper increments" has already been quoted.

Nowhere in the decision can be found the conclusion that "provision in advance of retirement should be made."

This habit of the FPC has been previously noted.[4] The FPC goes on in the St. Croix Falls case as follows:

"In fact, such provision is mandatory under our, and most, if not all, systems of accounts."

It is difficult to see how the language of the classifications referred to is any more mandatory than was that of the Federal Communications Commission and considered by the Court in the Telephone case. With respect to assertions by the FPC that good accounting practice demands that intangibles be written off, Mr. May, in the section of his book (Financial Accounting) devoted to writing off intangibles (page 155) says that this is "not supported by either reason or authority." Mr. May described as a "strange commentary" the next sentence in the Commission's decision, which follows—"In practice, tangible plant assets are generally depreciated, whereas intangible assets are amortized." In the same place Mr. May says that the significance of this sentence is not apparent since depreciation, in the Commission's parlance, is amortization.

Perhaps the FPC feels that it is meeting whatever limitation may have been imposed in the Telephone case. However, this writer's reaction to the decisions of the FPC is that, in connection with amounts classified in account 100.5, the Commission does not at any time concede that such amounts are "provisionally a true investment." The Commission's decisions give the impression that in all cases these amounts are not true investments and must be written off. Furthermore, it seems that the Commission seeks to establish this proposition by mere reiteration and by reference to partial statements of accounting authorities. Thus, in Pacific Power & Light Company[5] the Commission says:

"It is common knowledge that intangibles have questionable continuing value even in an unregulated industry. They should not be permitted to rest permanently in the accounts of a public utility, and the record of this case shows that the proper accounting treatment is to amortize them rapidly."

In connection with the above and the reference of the FPC to G. A. D. Preinreich,[6] Mr. May says, (page 156) that:

"examination of authorities cited in that author's careful compilation .... will show that there is ample authority for the view that it is permissible to write off intangibles; some support for the view that it is wise to write them off; some authority for the view that amortization is called for in special cases, but little, if any authority for the view that amortization is generally mandatory."

In California-Oregon Power Company[7] the Commission says:

"There is affirmative testimony in the record by the staffs of the Commissions which clearly indicates the excess of acquisition cost over original cost represented payments for nuisance value, going value, franchise value, monopoly value, and other similar intangibles." . . . .

"It is not necessary to theorize as to the specific type of intangible which this excess represents. The intangibles represented by the excess all have a tendency to merge one into the other and can principally be explained in terms of potential earning power. They represent basically a capitalization of that factor. It is because of this single dominant element common to such intangibles that sound accounting dictates their rapid elimination."

Reference can be made to many more cases but the theme appears to be the same, namely, all book cost in excess of corporate cost (or system cost in case of acquisitions from affiliates), which is to be classified in account 107—Plant Adjustments, shall be written off immediately and all excess of corporate cost in excess of original cost, which is to be classified in account 100.5—Plant Acquisition Adjustments, shall be amortized as quickly as possible. With the first proposition, relating to account 107, there should be no disagreement, conceding proper classification.

The SEC does not have primary jurisdiction over the accounting of public utilities except with respect to subsidiaries of registered holding companies which are not otherwise subject to the jurisdiction of the FPC or a state commission. However, it has taken a large hand in dealing with this same question by reason of the many applications which come before it in refinancing and other matters. In most cases where a company subject to its jurisdiction is obliged to make application to the SEC for approval of a desirable refunding or other corporate transaction, that Commission has apparently attempted to anticipate the findings of the FPC which may ultimately be developed by an original cost investigation. In many cases it has required such companies either to recapitalize so as to provide for the elimination of the difference between present cost and original cost or to initiate a program of amortization or reserve provisions designed to accomplish the same ultimate objective.

In Southern Colorado Power Company[8] the SEC required the immediate writeoff and rejected future amortization of the difference between present cost and original cost where the amounts related to property which was 10 years old at acquisition and now 40 years old. It said that:

"During the 30 years in which these properties have been held by the present company, the excess cost applicable to them should have been substantially, if not entirely, amortized."

In the case of Florida Power & Light Company[9] there was some question as to whether the excess of system cost over original cost represented tangibles or intangibles. The Commission said that in either event it was compelled to the conclusion that conservative accounting would have required that it be disposed of in whole or in part by this time. With respect to intangibles it said:

"As an intangible it would represent what is variously termed good-will or going concern value, and as such should have been amortized over a relatively brief period of years. As is stated by Paton and Littleton in their 'Introduction to Corporate Accounting Standards' (1940) pp. 92-93:

'The cost of good-will included in the purchase price of a going concern is essentially the discounted value of the estimated excess earning power—the amount of the net income anticipated in excess of income sufficient to clothe the tangible resources involved with a normal rate of return. . . . . An investment in anticipated excess earnings should be construed as a temporary investment, recoverable within a period of a few years.' "

In this case the SEC also cites cases of the FPC and the Interstate Commerce Commission in support of its views.

Here is an instance where the SEC offers part of a broad general treatise in support of its position. The SEC fails to note that Paton and Littleton suggest that purchased good-will "should be absorbed by revenue charges—during the period implicit in the computation on which the purchase price was based."

Public utilities are regulated monopolies. As such they cannot have excess earnings and therefore can have no good-will. Furthermore, they are continuing enterprises and can hardly be classified in a category of enterprise to which the rule laid down by Paton and Littleton should apply. In the opinion of this writer the reasoning of the SEC is not persuasive.

Thus it can be seen that without judicial expression and solely by reiteration; by the opinion of their own experts, and by reference to the opinions of each other, the commissions are developing a philosophy which already seems to have an elaborate

background of precedent, albeit self-serving.

What is wrong with the position that a utility should be entitled to retain the cost of an intangible if, as the Supreme Court said in the Telephone case, it "is a true increment of value?" Why is it not true that, when a prior owner has developed a utility, taking it with "blood, sweat and tears," so to speak, through its growing pains to a point where it is an established enterprise able to earn a fair return, value has been created in excess of the cost of the sticks and stones necessary to build the physical plant? Why should not that prior owner seek to be paid for that value in the event he sells it to another person? And why should not the successor owner be entitled to retain in his accounts the cost of that asset? Furthermore, why should not the succeeding owner be entitled to seek to be paid not only for the cost of the value which he purchased but also for any increased value which he may have created during the period of his ownership, and why should not the next owner be entitled to retain in his accounts the cost of such asset? Why is it not true, so long as the succeeding owner maintains the operations of the utility on a profitable basis, that the intangible investment purchased should remain a part of his assets at its cost? In the Telephone case, the Court said that any such amounts that are deemed, after a fair consideration of all the circumstances, to represent an investment which the accounting company has made in assets of continuing value will be retained until such assets cease to exist or are retired.

"Going Value"

The kind of intangible value described above is not good-will. Perhaps its best description is "going value" but, if so, this writer denies the validity of the assertion that it has a tendency to merge into other types of intangible for which the only sound treatment is early writeoff. Nor can it be conceded that it is so inevitably associated with the physical units which happened to be serving the area at acquisition that it must be concurrently eliminated when such units are replaced. This elimination is only justified when the utility either has completely ceased doing business in the area or has failed to maintain profitable operations therein. Notwithstanding that these commissions are apparently straining in all directions to establish the fact, it is hard for this writer to believe that the authorities which they cite are talking about this sort of asset. It would appear that the commissions are simply making the rules as they go along.

If such are to be the rules, however, it would seem that the commissions should be consistent in allowing the full effect of their conclusions to be applied in a straightforward manner. It would seem that they ought to (a) allow these costs to be written off above the point of return rather than below, where they are borne solely by investors (the FPC has uniformly asserted that the amounts must be charged to account 537—Miscellaneous Amortization, rather than to account 505—Amortization of Electric Plant Acquisition Adjustments) and (b) request that the revenue acts, both state and federal, should be amended so as to permit the utilities to deduct any amounts of such cost required to be written off which are a proper part of the tax base. So far as this writer knows, the State of Wisconsin is the only political subdivision which has thus amended its income tax statute.

1 Financial Accounting, 1943.
2 299 U. S. 232.
3 FPC Opinion No. 72—1942.
4 "Full Disclosure," Journal of Accountancy, January 1941, and "Accounting Principles and Regulatory Expediency," Journal of Accountancy, February 1941.
5 FPC Opinion No. 84, 1942.
6 "The Law of Good Will," G. A. D. Preinreich, 1936.
7 FPC Opinion No. 87, February 1943.
8 Holding Company Act Release 4501, August 1943.
9 Holding Company Act Release 4791, December 1943.

Reporting Requirements for Gas Companies Reduced

THE Federal Power Commission announced January 10 its transmittal of a letter to the executives of the nation's major natural gas companies advising that 23 schedules need not be prepared for the annual report form (FPC Form No. 2) to be submitted by such companies covering the year 1943. The Commission also modified its reporting requirements with respect to four other schedules in the report and agreed to accept, from natural gas companies utilizing the mimeograph method of preparation, a total of 46 schedules from the annual report form for electric utilities (FPC Form No. 1) for which die-impressed mimeograph stencils have been prepared to make more economical the preparation of multiple copies.

The action follows a similar reduction made in reporting requirements from electric utilities effected December 31 and was taken in recognition of the shortage of trained personnel during the war.

The reduction, which will minimize the time and labor required to prepare FPC Form No. 2, follows conferences with the Committee on Statistics and Accounts of the National Association of Railroad and Utilities Commissioners, of Utilities Subcommittee of the Advisory Committee on Government Questionnaires, the Bureau of the Budget, and representatives of the American Gas Association and the Edison Electric Institute.

The letter states that the omissions and modifications apply only to reports for 1943, and carries the same limitation with respect to the substitution of schedules from the annual report form for electric utilities.

Gas Gild Moves

HEADQUARTERS of the Gild of Ancient Supplers of Gas Appliances, Skills, Gins, Accessories and Substances have been moved to 201 South 42nd St., Philadelphia, Pa.

New Book Published on Internal Auditing

A FURTHER contribution to accounting literature has been made by The Institute of Internal Auditors, Inc. with the publication of a second book on internal auditing, entitled "Managerial Control Through Internal Audits," by Dr. Victor Z. Brink. The first Institute book "Internal Auditing: A New Management Technique," was published last year.

In Dr. Brink's book, the Institute has endeavored to present a concise, non-technical description of modern internal auditing, and the many vital functions it fulfills for progressive business management. It is the author's purpose in this volume to point out how business management can best utilize the internal auditing staff; how, as a tool of management, internal auditing has progressed beyond the arithmetic verification of accounts, and how it has become a complete intra-company financial and operational review.

The author has had practical experience as an internal auditor with The Pure Oil Company, in public accounting with Arthur Andersen & Company, and in teaching at The Tuck School of Business Administration of Dartmouth College and at the School of Business, Columbia University. He was also research director of The Institute of Internal Auditors.

Inquiries concerning the book should be addressed to The Institute on Internal Auditors, Inc., 120 Liberty St., New York, N. Y.

Natural Gas Companies Organize Trade Group

REPRESENTATIVES of natural gas producers and pipeline companies, at a meeting in Kansas City last month, organized a trade association, the Independent Natural Gas Association of America. Its principal purpose will be to promote the natural gas industry in the United States, particularly in representing the industry before legislative and administrative bodies.

To give equal representation to producers and pipeline companies, the following directors were elected: M. H. Adams, treasurer, Stevens County Oil & Gas Co.; E. Buddrus, president, Panhandle Eastern Pipe Line Company; R. L. Carr, president, Columbian Carbon Co.; J. H. Dunn, vice-president, Shamrock Oil & Gas Corp.; A. B. Harper, president, Arkansas-Oklahoma Gas Co.; D. D. Harrington, Hagy, Harrington & Marsh; L. E. Ingham, vice-president, Kentucky Natural Gas Corp.; P. R. Johnson, president, Union Gas System, Inc.; E. C. Joullian, president, Consolidated Gas Utilities Corp.; Paul Kayser, president, El Pasco Natural Gas Co.; Oscar Nelson, president, United Carbon Co.; W. C. Skelly, president, Skelly Oil Co.; W. H. Wildes, president, Republic Natural Gas Co.; and C. H. Zachry, vice-president, Southern Union Gas Co.

The Residential Gas Program for 1944

C. V. Sorenson

• Herewith the MONTHLY presents summaries of the major activities planned by the Residential Gas Section for the current year. A report on the Housing Committee appeared in the January issue and the Window and Store Display Committee's work is described elsewhere in this issue. Programs of several committees are not yet fully developed and will be announced later. These include committees on Market and Economic Research, Coordinated Kitchen, Selection and Training of Sales Personnel, and Appliance Financing.

• Commenting upon the 1944 program of the Section, C. V. Sorenson, chairman, said: "One of the principal tasks during the coming year will be to act on the suggestions made by the Postwar Planning Committee as a result of its study of Postwar Potential Markets and Probable Business Conditions. It is realized as the war progresses that the necessity for preparation to serve adequately postwar customer demands becomes increasingly apparent. A great deal of preliminary work will have to be done and this is being provided for in the plans of the various standing committees."

WATER HEATING COMMITTEE

C. S. Stackpole, Chairman

The Gas Water Heating Committee has completed its roster for the coming year and plans are being formulated for future activities revolving around this most important phase of the gas business. Retention of the existing domestic water heating business and addition of as much new water heating load as possible are definite "musts" in the postwar gas utility picture. Not only will there be great opportunities in the homes already built, but a tremendous new market will be opened up in the new construction field which, we are told, will lead the upswing as we return to a peacetime economy.

It was the consensus of opinion of last year's committee members that the promotional aspects of a CP water heater program were the most important ones to be discussed, and it is planned to continue and intensify these discussions during the coming year. The plan is to make CP the merchandising vehicle which can be used by the industry's salespeople to convince prospective purchasers that the CP gas water heater is the best obtainable as to equipment, installation, efficiency and performance. The scope of such a program to be finally decided upon depends on the amount of money made available through the cooperation of all branches of the industry. The committee is looking forward with real interest to the time when it can review the results of the water heater section of the Association's questionnaire which was sent to the gas utility members during the latter part of 1943. The committee will be guided materially, of course, by the answers and recommendations contained in these questionnaires.

While the proposed CP program is an outstanding matter on the coming year's agenda, there are many other subjects which will receive attention, including the following:

(1) The manufacturer members of the committee will be asked to continue to follow up the matter of ample supplies of parts and boilers, in order that adequate and reasonably prompt repair service may be rendered on existing water heaters, as well as to do what they can to obtain material to make new gas water heaters for replacement purposes. All of this, of course, to be done without adverse effect on any of the war effort.

(2) The Water Heating Committee plans to point out to the proper Association committee the desirability of suitable promotional rates for the continuing expansion of the water heating load.

(3) In connection with the subject of water heater installation specifications which will be discussed as part of the CP program, it is planned to have representatives from Association headquarters give the committee their assistance by attending meetings of the committee and presenting pertinent information and data resulting from their contacts with prefabricated home manufacturers, large builders, architects and consulting engineers. The subject of gas automatic storage water heater specifications and standardization will be discussed by the committee after it has heard a summary of the work which has been done by the A. G. A. Water Heater Requirements Group by a member of the headquarters staff.

(4) The committee will continue its efforts to obtain data on the cost of gas versus competitive fuels for water heating. Such information when obtained will be disseminated to all of the people interested.

(5) Every possible tie-in will be made with other committee programs, including any packaged kitchen program which may be set up for postwar.

(6) Suggestions for new and improved equipment such as the development of some type of low-priced automatic equipment for low-income customers as well as the inclusion of water heating equipment as a part of gas-fired house heaters, the latter to put us in a position to meet the competition of oil summer-winter hookup where necessary.

(7) The committee will discuss at its meetings suggestions which have been passed on to it by non-members, including the possibility of a close tie-in with the work being done by the Cleanliness Institute prior to the war to get over to potential users the great need for an adequate everyday supply of hot water at controlled temperatures; the new story and the great interest which can be created around water heaters of the glass lined and nonferrous types. It has been suggested

C. S. Stackpole

that the Water Heating Committee, in setting up its future plans, should review and capitalize upon the water heating research recently conducted under the sponsorship of the Committee on Domestic Gas Research, with especial reference to the relative efficiency of different types of heaters. This suggestion will, like any others received, be followed.

The Water Heating Committee will welcome any and all suggestions or criticisms of its program, and hopes that more nonmembers of the committee will show an interest in this very vital subject by submitting their ideas.

COMMITTEE ON COORDINATING GAS APPLIANCE PROMOTION

Membership of this committee, which is a recent addition to the Section's committees, is comprised of the chairmen of the four appliance committees under the chairmanship of the vice-chairman of the Section. The primary function of the committee is to coordinate the activities of the four appliance groups and to work with gas companies, and gas appliance manufacturers in the production, promotion and sale of coordinated gas kitchens. It is felt that the work of this committee will be an important factor in increasing the sale of gas in the new home market.

HOUSE HEATING AND AIR CONDITIONING COMMITTEE

J. C. Sackman, Chairman

J. C. Sackman

During the coming year, this committee and its various subcommittees will continue their work in connection with the CP program for forced warm air furnaces including CP requirements for such furnaces and their proper installation, both regional and national. Plans for the promotion and sale for such equipment will be provided.

Recognizing the tremendous importance of summer air conditioning after the war, it has been decided that this would be handled by a special subcommittee and subchairman operating under the present committee.

The subject of direct gas space heating is being studied and it is planned to appoint a special direct heating committee, provided that the results of the Post-War Gas Appliance Questionnaire indicate the need for such a committee.

Plans for the future promotion and sale of house heating and winter and summer air conditioning, and special heating equipment, will be made by the committee who will also study and recommend needed improvements in such appliances and equipment.

COMMITTEE FOR IMPROVED DOMESTIC APPLIANCES

F. M. Rosenkrans, Chairman

F. M. Rosenkrans

This committee has the responsibility of establishing all CP appliance requirements. During the year it is anticipated that it will receive suggestions from various appliance committees for improvements to CP appliances, which will be considered in connection with the revision of CP requirements.

It is anticipated that the results of the national survey now being made on new and improved postwar appliances will be given full consideration by the committee. In this national survey, opportunity is being given to the gas companies of this country to register their recommendations for the development of new appliances to be sold by gas companies and appliance dealers during the postwar period.

The research work conducted by various laboratories will be reviewed by the committee in order that improvements in appliances resulting from such research can be considered in connection with revising and establishing CP appliance requirements.

DOMESTIC RANGE COMMITTEE

W. M. Chamberlain, Chairman

The Domestic Range Committee has set up its plans and program for the first six months of the year 1944. A prominent feature of this program will be the continuing of a national CP promotional program, under the auspices of the CP range manufacturers, based on the campaign theme "You Can Help Give Them Peacetime Jobs by Planning Now to Buy Your New CP Gas Range with Extra War Bonds."

A complete portfolio incorporating this theme, which points out the importance of providing jobs for returning servicemen and others, will be made available to all gas utility companies and their local dealers. It includes publicity material such as posters, advertisements, publicity releases, a postwar CP prospect form, and a CP war bond holder.

In addition, a series of specially-prepared advertisements will appear in trade journals, covering the gas, architectural, hardware, department, furniture store and appliance dealer fields. It is further planned to have publicity articles prepared by nationally-known writers for insertion in the press and magazines of the nation.

The committee will continue its activities toward further study and analysis of the current CP range specifications to the end of recommending further specifications to the proper committees. Of material assistance in this work, will be the results of the current postwar gas appliance survey.

W. M. Chamberlain

Recognizing the importance of the dealer and department store industries, it is planned to invite representative members of these groups to consult with the committee at stated intervals. It is further planned to cooperate closely with the Committee on Coordinated Gas Kitchens, and a special manufacturer's committee has been appointed to work with this group.

The Domestic Range Committee will continue its activities with the War Production Board, the OPA and other agencies, in their efforts to facilitate adequate gas range production and availability.

REFRIGERATION COMMITTEE

J. L. Johnson, Chairman

J. L. Johnson

While the lack of appliances to sell has curtailed the sales promotion activities of the Refrigeration Committee, this group is actively engaged in preparaing for the postwar period and in planning means of keeping the story of gas refrigeration before the public. To this end, a five-pronged program is being developed around the following points:

1. *Keeping the Industry Informed with Reference to the Resumption of Refrigerator Manufacturing.* Currently, there are appearing stories with reference to the resumption of manufacture of civilian goods. Automatic refrigerators have been included in the list of such goods which it is hoped will be manufactured in more or less limited quantities during the present year. Because of the interest which the gas utilities have in keeping up-to-date on the probabilities, the committee plans to send out information with reference to developments.

2. *Planning the Resumption of Sales Activities.* Planning to once again start selling gas refrigerators breaks down into short-term planning and long-term planning.

a. Short-term planning has to do with selling in the months that will follow the resumption of gas refrigerator manufacture. During this period, quantities will undoubtedly be limited and, presumably, sales will be made under some sort of governmental restriction, such as rationing. Sales forces will be limited as to personnel. Financing will be permitted only for relatively short periods, when compared to those in vogue in prewar days and those which we may presume will be available in postwar days.

b. Long-term planning has to do with that period when the fight is over "over there" but when the competitive fight is just beginning "over here."

3. *Adapting Activities to the "Coordinated Kitchen Committee" Program.* As one of the major features of this program, the gas refrigerator will come in for prominent consideration in promoting and merchandising Package-Kitchens. In the expectation that the departure will prove valuable in contributing toward this activity, the personnel of the Refrigeration Committee, for the first time, includes two home service directors—one from a manufactured gas area and one from a natural gas area. The Refrigeration Committee will hold itself ready to support the program of the Coordinated Kitchen Committee, which will shortly be underway.

4. *Periodic Mailing to Gas Industry Executives.* Commencing in March, it is proposed to send a series of mailings to the gas industry at intervals spaced about two or three months apart. These mailings are intended to keep the subject of gas refrigeration active in the minds of our people and to continue to keep the industry informed as to what's going on. It is the expectation that these mailings will become increasingly sales-promotional-slanted when we stand at the threshold of the resumption of merchandising activities. These mailings will be intended to impress the executives of the industry, as contrasted with the rank and file of employees.

5. *Mailing Pieces for Gas Company Employees.* This activity contemplates making available to gas utilities one or two mailing pieces during the present year, prepared especially for non-selling gas company employees. It is, of course, understood that the use of this material will be optional with the local utility. It is believed, however, to be an important contribution by the Refrigeration Committee in the light of changed conditions. As of the year 1944, local gas companies will have a considerable number of non-selling employees on the payroll who were not there in 1941, the last year in which gas refrigerators were merchandised. Taking our industry as a whole, this represents a tremendous number of individuals and their families. We are approaching the time when these folks should become gas refrigerator minded. These mailing pieces can be so prepared that they will pave the way for the resumption of employee-selling, employee-prospect-systems and other important employee tie-ins with gas refrigeration.

HOME SERVICE COMMITTEE
Ruth Sheldon, Chairman

Ruth Sheldon

THE Home Service Committee will continue its outstanding work in assisting the industry in the full and complete utilization of home service departments and personnel as a means of national and community service and in maintaining and increasing the public acceptance of residential gas services. An important 4 point program has been set up by the committee for the coming year as follows:

1. A survey will be conducted among the home service departments of the industry for the purpose of studying the results of the 1943 canning program as a basis for setting up a plan for 1944. The Plan report will be made available to the industry this spring for use during the coming year.

2. The second phase of the committee's plan is the subject of visual aids for wartime demonstrations keyed to present food information, solving food shortage problems, and providing basic cooking skills. A sub-committee will prepare a set of visual aids for a group of demonstrations to be presented in booklet form as a pattern for member gas companies.

3. Realizing that the young people of today are the homemakers of tomorrow and that many children are selecting and preparing food while their parents are at work in war plants, the committee is making special studies to meet this situation. It is planned to work up a series of 4 lessons or demonstrations for use by gas companies, locally, possibly tying in with School Victory Clubs and other national activities such as the Girl Scouts, the Campfire Girls, etc.

4. The subject of Wartime Home Calls will be considered by a special subcommittee to report on what is being done on this important phase of home service work by gas companies throughout the country in view of current problems of transportation and personnel.

While the conservation of food, fuel, time and womanpower is important in the wartime picture, still it is realized that so many outside groups—government agencies, business groups and state colleges—are working on these subjects, that further work at this time would be duplication for the Home Service Committee. The plan instead is to consider procedures directly adaptable to home service needs.

There is in sight no relaxation of controls and pressure on the home front, and a major job of home service this next year is to continue to help people understand the why and what of rationing; of conservation of food through preservation; of utilization of food to avoid waste, and of helping the youngsters in their home jobs. This assistance will prove again that the gas company home service departments in all wartime goals are on the beam.

New CP Gas Range Program Aimed To Build Postwar Sales

FINDING jobs for more than 10 million service men and millions of more jobs for war workers is one of the major problems facing postwar America, and it is up to American business to create those jobs," said Lloyd C. Ginn, chairman of CP Gas Range Manufacturers' Sales Management Committee, in announcing a nationwide CP Business Building Plan designed to create a backlog of orders which will start peacetime industry's wheels turning immediately after the war.

Built on the theme, "You Can Help Make Peacetime Jobs for Service Men and Women by Planning Now To Buy Your New CP Gas Range with Extra War Bonds" the CP Business Building Plan will urge the 18 million brides-to-be to set aside \$100 to \$150 extra in War Bonds now to buy a CP gas range when new peacetime models are available. The current CP campaign consists of three steps:

1. Customers are urged to set aside \$100 to \$150 in extra War Bonds now so they can buy a new CP gas range immediately after the war.
2. From a special postwar CP prospect card, gas range dealers and utilities will obtain information on exactly what type of CP gas range each customer wants together with other pertinent facts. This prospect card is filed for later follow-up and sale.
3. No money changes hands. No contracts are signed. But definite orders can be taken and priority listings set up if the individual dealer desires.

In addition to increasing the sale of War Bonds and helping to make good jobs for service men and women immediately after the war, this program will enable gas utilities, department, furniture, hardware stores and other gas range dealers to presell gas for cooking and CP for certified cooking performance and to build now profitable postwar business on high quality gas ranges.

By buying extra War Bonds now, prospective purchasers can create a financial backlog and buy a CP gas range out of earnings without interfering with savings plans, CP range manufacturers point out.

Because of its flexibility and simplicity, dealers and gas utilities do as much or as little as they wish with the program and can

A standard element in new CP advertising program

expand it to cover all items they handle.

A complete kit giving full details of the CP Business Building Plan, and containing a colorful 25 x 38 inch window-display poster, a unique War Bond holder, bill stuffers, counter pieces, ready-to-run newspaper advertisements, stickers to be used on letters, mailing pieces and bills, publicity releases, prospect cards and other material is available on request from the Association of Gas Appliance and Equipment Manufacturers, 60 East 42nd Street, New York 17, N. Y.

The Bond holder is designed to be used as a safe depository for all the War Bonds owned and contains a unique sheet on which Bonds owned can be listed and the sheet kept separately so that if Bonds are lost, a record is available from which duplicates can be issued.

As a part of the campaign, dealers and utilities are urged to set up a Postwar Home Planning Center and to assist their customers in planning their peacetime purchases. The program also includes a plan by which every employee can become a salesman for postwar selling.

The campaign will be supported by direct mail and publicity programs, newspaper advertising and trade paper advertising in the department store, hardware, furniture, appliance dealer and gas utility fields.

BROOKLYN RANGE SURVEY

(Continued from page 66)

7. Most gas ranges are hard to clean. The burner box, which needs the most cleaning presents such an array of parts that many housewives are frightened away from any attempt to clean it. As a result, gas ranges are considered by many to be necessarily dirty appliances.
8. Tenants in multi-family dwellings were particularly indifferent. Ranges installed in apartments are usually purchased on a price basis by speculative builders who are not interested in range performance or life. As a result, tenants are accustomed to inferior ranges and the selection of an apartment is not affected by the type or quality of the gas range. Poor burner adjustment is common in these homes and the tenants usually do not take any steps for betterment.

Comment

This survey has been beneficial to our company from several viewpoints. We not only had a pleasant visit with a large number of domestic customers, but, in addition, definitely raised their opinion of us and our fuel. We rendered service which was highly appreciated and learned considerable of what our customers are thinking, particularly among classes of people whom we ordinarily do not reach in any great number. The sales personnel who did the survey work received invaluable experience which will be of help in future selling. The information gained will be of value to us and appliance manufacturers in formulating future policies and practices in both sales and service.

Letters to Customers

As previously explained, a letter of inquiry was sent at the conclusion of the survey to five hundred customers at whose homes survey calls had been made. It requested comments on the service rendered or other phases of the survey. Eighty replies have been received. Most of them are illuminating and many are extremely valuable in that they represent the opinions of customers who not only gave the subject some thought but who also took the trouble to write us a letter about it. Throughout the replies, the three following reactions are found to predominate:

1. An appreciation of a gratuitous and unexpected service by the gas company.
2. Range reported as operating more satisfactorily.
3. Realization that faulty range operation is not a necessary evil but rather one that usually can be corrected by simple adjustments.

The following are a few excerpts from typical letters.

1. "All burners now light. No waste gas now."
2. "The call was a wonderful idea. Range was bought from a plumber and installed by him, evidently the same way he received it from the factory, making no adjustments and it operated very unsatisfactorily until your man adjusted it."
3. "Easier to cook now. I hope the gas company keeps up doing this fine job for the duration."
4. "Didn't know that you repair ranges free of charge."
5. "Originally there was one burner which was useless—now it burns with a good flame. Deep appreciation for the visit of your representative."
6. "Your representative adjusted oven pilot after which it worked for the first time since we're using the stove. Pilot has been on the go ever since. He did a good job."
7. "Showed me how to keep pots and pans from becoming all black on the bottom. You may continue to render this service."
8. "Since the call, the range has been in perfect working order."
9. "Faulty operation of the range was due to the fact that no one apparently was able to adjust it, yet when your mechanic inspected it only a few minutes were required to correct the defects and it has given no trouble since. You see in most instances where the public wishes a service of this sort, the fees are so exhorbitant for a minor adjustment that the average person hesitates to call a repair man, hence all the faulty ranges, electrical appliances, radios, et cetera."
10. "Range working tops since your representative made the adjustment."
11. "The console type range was just the thing. Why change it?"
12. "Range improved tremendously."
13. "Before, the cakes always burned when I had the thermostat set at moderate temperature. It means a lot when heat control is correct."
14. "An improvement in the range was very noticeable."
15. "Make the future range 'as brief as possible' in order to save space and make cleaning easier."

Grand Rapids' New Home Service Director

MRS. MARGARET WOODMAN ANDERSON has been appointed home service director of the Grand Rapids District of Michigan Consolidated Gas Company. She succeeds Lucille M. Hall who resigned December 15 because of her recent marriage.

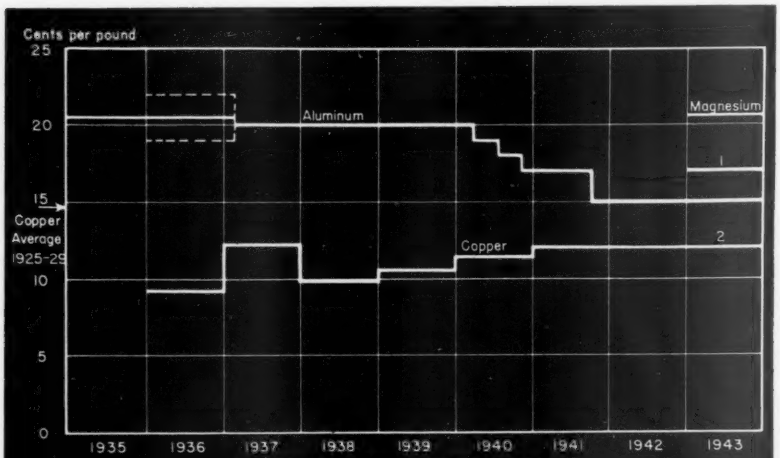
Mrs. Andersen has been a key member of the Grand Rapids' home service staff for the past five years and is well qualified for her new position. She was graduated from Michigan State College with a Bachelor of Science degree in Home Economics in 1938.

Miss Hall, home service director for the past six years, has served on the American Gas Association Home Service Committee for several years and was Chairman of the Mid-West Home Service Committee in 1940.

Gas for Heat-Treating Aluminum and Magnesium

• The Heat-Treatment of Aluminum and Magnesium is the title of a report being mailed to all member gas companies. Additional copies will be available at a nominal price for distribution to industrial gas customers and their engineering personnel. The report is the second issued by Project No. 1 Subcommittee of the Metal Melting and Treating Group of the Industrial & Commercial Gas Section. It will be further discussed at the 1944 A. G. A. War Conference on Industrial and Commercial Gas in Rochester on March 30-31, 1944.

• The portion of the report reproduced here deals with the economic significance of aluminum and magnesium in relation to the gas industry. The complete report carries detailed technical treatment of various alloys and the design of gas furnaces for optimum results.



COPPER, ALUMINUM, & MAGNESIUM PRICES
1 Copper price for quantities above mine quotas
2 Copper ceiling price

By C. GEORGE SEGELER
Chairman, Project No. 1 Metal Melting and Treating Subcommittee

THE gas industry has a real stake in the present and future development of the aluminum industry because there are so many applications of heat in the manufacture of an aluminum article from the time the ore is mined until the finished product is delivered. A large portion of this gas is needed for the heat treatment of aluminum alloys for, in contrast to other metals, there is relatively little aluminum which is not heat-treated.

This emphasis on heat-treated aluminum alloys is, in itself, a relatively modern development, stemming from the widespread use of the so-called strong aluminum alloys needed because of the expansion of the aeroplane industry.

Over a ten-year period, aluminum has jumped into prominence, not only by its increased production, but by the steady lowering of its price. Today, aluminum ranks with copper in importance as a metal, as can be seen from the chart on the opposite page, which shows the comparative position of aluminum and copper production in the United States for the last ten years. It may be noted that, although the tonnage of copper is still greater, the light weight and high strength of aluminum alloys make a pound of aluminum go further. Chart above shows the price trends of aluminum and copper.

When peace comes once more, the production facilities for aluminum which were constructed during the war offer the possibility of low-cost aluminum for all types of metal fabrication. Aluminum and its alloys can be forged, spun, extruded, stamped, cast, and otherwise treated to produce practically any shape product. Aluminum alloys are strong and light and offer advantages over other metals as a result of these properties. It is most unlikely that the increased capacity for making aluminum will be shut down after the war if any market can be found or developed for the available tonnages. There are already straws in the wind pointing to the great interest in aluminum fabrication on the part of copper and brass mills, many of whom have already installed large amounts of equipment for handling aluminum products.

Another unusual aspect of aluminum production is the fact that it is made in widely separated geographical areas, the ores being shipped from the mines to the places where the electrolytic plants are located. The aluminum production plants are primarily located with an eye to cheap electric power to provide the 10 K.W.H. needed for every pound of aluminum extracted from the ore. The production of aluminum has been in the hands of two major companies who are large, adequately financed, and with capable, aggressive management. It may be anticipated that they will be liberal in the expenditure of development funds to foster increasing civilian use of aluminum once the war demands for airplane materials slacken. These points are of interest because they indicate that ample quantities of aluminum will be available with low shipping charges at many centers of production.

Significance to Gas Industry

The fact that aluminum has grown in importance would not justify so much emphasis in a report on gas heat-treating, except for the influence that this growth may have upon the use of industrial gas. It was only a few years ago that the bulk of aluminum heat-treating was carried out in electric furnaces. In fact, this idea was so widespread that the primary assignment of the 1942 Project No. 1 Subcommittee of the Metal Treating and Melting Committee of the A. G. A. was to establish whether Federal specifications for aluminum alloys covered the use of gas in a proper manner. Fortunately, this proved to be the case, and the publication of the facts has reassured the industry gas engineers regarding the application of gas to aluminum heat-treating. Furthermore, it has focused attention upon

this problem, and in this report a survey has been included showing the extent to which gas is now used for aluminum heat-treating in major United States production centers.

If it is conceded that aluminum alloys are likely to become the most important non-ferrous metal products, practically all of which require extensive heat-treatment, then the gas engineers have an important job in learning both the theoretical and practical side of all of the heat-treatments which may be involved. The gas industry, as this report shows, sells a large amount of gas for this purpose, an amount partially due to the large tonnage and partially to the relatively longer heat-treating time required for many aluminum alloy products.

Looking back on the history of applying gas for heat-treating in general, it may be remembered how slowly gas reached its present prominent position. There were competitive struggles with other fuels and electricity. There were many arguments about the quality of the product which came from gas-operated furnaces. Today the use of gas is general in both ferrous and non-ferrous heat-treating. The last two years have witnessed almost equal progress in the application of gas to aluminum-treating.

Gas versus Electricity

In the heat-treatment of aluminum products, there has been keen competition between gas and electricity, the latter having a head-start largely because the wrought alloys containing magnesium as well as silicon, exemplified by such products as alloy 24-S, react to moisture, especially if sulphur compounds are also present. It seemed easier to avoid reactions when no flue products were present, but even in an indirect or an electric furnace, moisture from the air sometimes can cause trouble. If a large stack of cold sheets is put into a furnace, moisture may be condensed and collect between the sheets to cause trouble.

It is only since about 1939 that aluminum castings were heat-treated outside of a few of the largest processing plants like the Aluminum Corporation itself. The principal cast products were made with alloys of the copper aluminum family (No. 195 alloy group) which is not adversely affected by furnace atmospheres except under unusually bad circumstances. Thus, there always was a certain amount of gas used for heat treating alloys of this type. With the advent of the more specialized alloys, like No. 355 and No. 356, containing a small amount of magnesium in the presence of silicon, furnace atmospheres became subjects of concern as far as the cast materials were concerned. However, it should also be noted that good work was not the result of using electricity but depended on its proper application. Unsatisfactory products continue to be produced where improper types of electric furnaces are used.

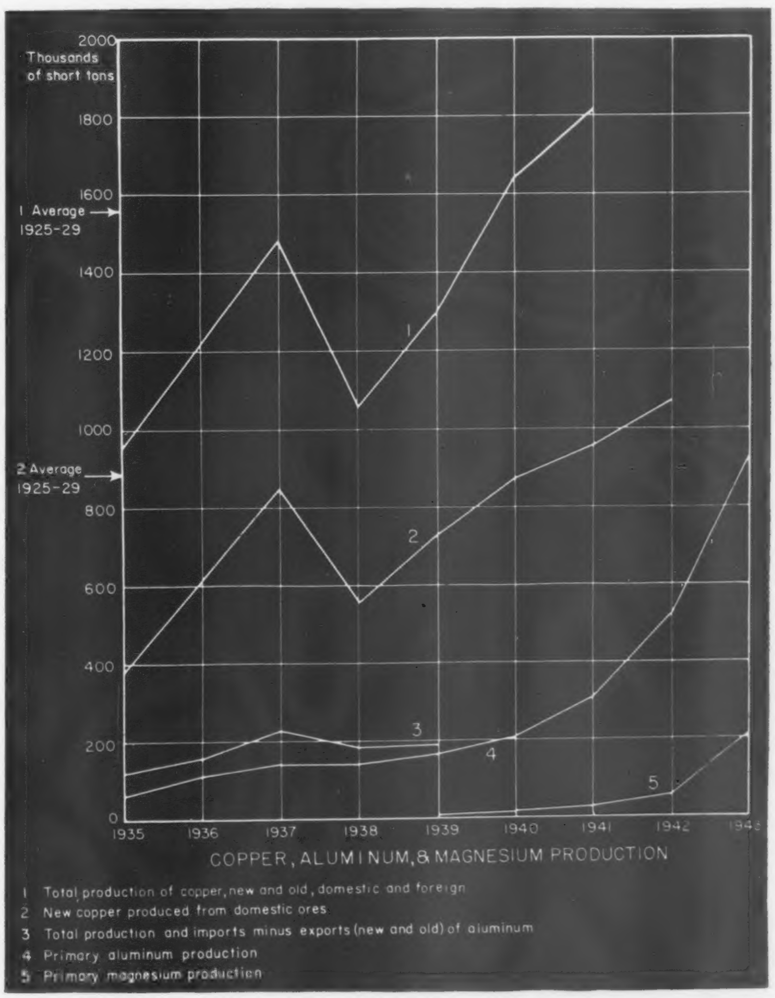
Electric heat-treating equipment was selected by many of the war industries for both wrought and cast products in spite of higher operating cost and higher maintenance cost because it was believed that a better product would result. In any event, the material turned out by those electric furnaces which were selected by the first plants to be constructed turned out to be satisfactory, and there was thus a natural tendency for subsequently erected plants to follow the line of least resistance and use the same source of heat. Electricity received considerable publicity, and it was favored by certain government specifications.

The gas industry persistently attacked the problem and, in a number of locations, gas was selected for heat-treating various aluminum products. These proved to be just as good as anything that could be produced in electric furnaces and at much less cost. The trend to gas quickly turned upward. The gas industry can now prove its fuel is second to none for heat-treating aluminum, provided that the proper type of equipment is used for the purpose. Certain large aluminum production centers now use far more gas than electricity, completely reversing the earlier trend. This is so significant a change that this committee has felt it desirable to include a survey of the methods used for heat-treating aluminum alloys in a number of large fabrication centers including Detroit, Chicago, Brooklyn, etc. because of their outstanding importance.

Use of Gas for Aluminum

Heat is required in large amounts in the driers employed after chemical purification of aluminum ores. There are a number of natural gas applications in this field, principally Alabama and Arkansas. The purified ore is shipped to the electrolytic reduction plants. This process uses electricity both for the heating of the cryolite baths and for electrolizing the alumina. There is an opportunity for gas application for the remelt furnaces, ladle heating, and auxiliary plant uses.

The unrefined pig made in this manner contains dross and other nonmetallic impurities which are removed by subsequent remelting, at which time appropriate alloys are added. These remelt furnaces are of various types, depending upon the product involved, the larger ones being open hearth construction, largely fired by coke in the United States. However, there are some gas-operated open-hearth aluminum furnaces from which the metal is cast into shapes



convenient for subsequent manufacture as wrought alloy. Sometimes the remelting is followed by casting directly into finished or semi-finished shape. Gas-fired furnaces of the pit crucible or tilting crucible types have had considerable application in this field.

The aluminum intended for wrought alloys is extruded or rolled into the desired shape. There is therefore considerable deformation which would cause cracking of the relatively brittle cast ingots. As a consequence, the first forming is carried out at elevated temperatures so that there is a preheating operation generally carried on between 850° and 900° which also serves to homogenize and soften the cast structure so as to prevent cracking.

Materials that are cold-formed become hardened as a result of deformation so that intermediate annealing operations are required from time to time to soften the metal. These are carried out by heating to the annealing range which is between 640° to 670° F.

Gas is also used as a principal melting fuel in the aluminum die-casting field.

From the point of view of the gas industry, the most significant heat-treating operation is the solution heat-treatment and aging for maximum strength and for other optimum physical properties. Solution heat-treatment is commonly called just "heat-treatment of aluminum." It is followed by the appropriate quench and may subsequently require a further precipitation or age-hardening treatment. The opportunity for using gas for this work will undoubtedly expand with increasing production of aluminum alloys both during the war and in the future.

Magnesium

The data shown in the chart on page 85 includes, as curve No. 5, the picture of growing magnesium production. The increase on a percentage basis has been extremely high as is to be expected with an industry that was practically in its infancy in the United States in 1939. The tonnage of magnesium produced during 1943 puts this metal in the position where aluminum was in the pre-war years. The price of magnesium at 21¢ per pound is about at the pre-war aluminum levels. These points naturally invite a comparison between aluminum and magnesium and speculation as to its probable future.

Based on present figures, the amount of gas required for the handling of magnesium products is considerably smaller than that required for aluminum. There might, therefore, be less immediate interest in this market for gas. However, those particular fabricators who are using magnesium are looking to the gas industry for assistance in the solution of their heat-treating problem. Locally, therefore, magnesium work may assume considerable importance, sufficient, at least, to justify this committee in bringing up-to-date the available information.

Magnesium, like aluminum, is a widely distributed element in the earth's crust, but the principal sources from which it is commercially produced are the magnesium con-

(Continued on page 95)

Industrial & Commercial Gas War Conference

THE 1944 American Gas Association War Conference on Industrial and Commercial Gas will be held on March 30 and 31 at Hotel Seneca, Rochester, N. Y., it has been announced by Charles G. Young of Springfield, Mass., chairman of the Industrial and Commercial Gas Section.

The three-fold objective of the conference is: (1) to study equipment and practices in gas utilization in war production plants and military camps and bases so that improvements can be applied wherever they will help the war effort; (2) to study the requirements of altering or replacing old industrial gas equipment in war plants and to rehabilitate commercial equipment during the coming reconversion period; (3) to plan for maximum industrial and commercial gas and equipment sales in the postwar period.

This conference alternates yearly between natural gas and manufactured gas territories. A balanced program including subjects of interest to both natural gas and manufactured gas men and equipment manufacturers in the industrial and commercial field will be presented. The program committee is under the able direction of Ivar Lundgaard, manager, industrial department, Rochester Gas and Electric Corporation. Mr. Lundgaard's committee consists of R. Victor Bauer, Ebasco Services Inc., New York, N. Y.; Karl Emmerling, The East Ohio Gas Co., Cleveland, Ohio; Henry M. Heyn, Surface Combustion, Toledo, Ohio; F. B. Jones, Equitable Gas Co., Pittsburgh, Pa.; Ralph L. Manier, Central New York Power Corp., Syracuse, N. Y.; James C. Patterson, Carrier Corporation, Syracuse, N. Y.; Leo Sullivan, Rochester Gas & Electric Corporation, Rochester, N. Y.; Eugene D. Milener, Secretary, American Gas Association, New York, N. Y.; Charles G. Young, ex officio, Springfield Gas Light Co., Springfield, Mass.

Industrial and commercial gas men, sales managers and executives, equipment manufacturers and engineers are advised to make their hotel reservations as early as possible with the hotel.

American Gas Association Industrial and Commercial Gas Advertising for February

The National Advertising Committee of the Industrial and Commercial Gas Section, J. P. Leinroth, chairman, and F. B. Jones, vice-chairman, announces that full page advertisements will appear in the trade and business magazines listed below during the month of February. These advertisements are prepared in cooperation with the Committee on National Advertising as a part of the industry's national advertising campaign.

MAGAZINE	THEME
	General Manufacturing
BUSINESS WEEK (Feb. 26—⅔ page)	"Maybe Gas 'furnaceless heating' can fit into *your* postwar production!"
	Metals Industry
INDUSTRIAL HEATING THE IRON AGE (Feb. 10) METALS AND ALLOYS METAL PROGRESS STEEL (Feb. 21)	"Getting set for postwar operation? Check into how GAS equipment, drafted for war, is being improved for peace!"
	Ceramic Industry
CERAMIC INDUSTRY	"The peacetime door is *wide open* for CERAMICS. War's pressures have created new opportunities in which *Gas* firing shares."
	Baking Field
BAKERS WEEKLY (Feb. 14)	"The military's experience with modern GAS equipment will help you after the war!"
	Hotel and Restaurant Fields
RESTAURANT MANAGEMENT HOTEL MANAGEMENT	"Why military foods get better . . . trained dietitians and up-to-date *GAS equipment* make a strong team."
	Hospital Field
MODERN HOSPITAL	"'What's Cookin'? . . . that's awfully important to the boys back from Guadalcanal or Italy! . . . and modern *GAS* cooking is helping skilled dietitians to use food as medicine in promoting recovery."

Factors in the Production of Gasoline from Coal, Natural Gas and Petroleum

• A memorandum presented bv R. P. Russell, executive vice-president, Standard Oil Development Co., to the Subcommittee on War Minerals of the Senate Committee on Public Lands and Surveys, in connection with his testimony, Aug. 3, 1943. This material was also published in National Petroleum News for September, 1943.

• Chapter 6 of the report of the A. G. A. Chemical Committee for 1926 contains an excellent description of the Fischer-Tropsch synthesis process. An eight-page article by K. C. Appleyard entitled "Production of Oil From Coal by the Fischer-Tropsch Process," appeared in the London Gas World, July 1, 1939. This article is on file in the Association's library.

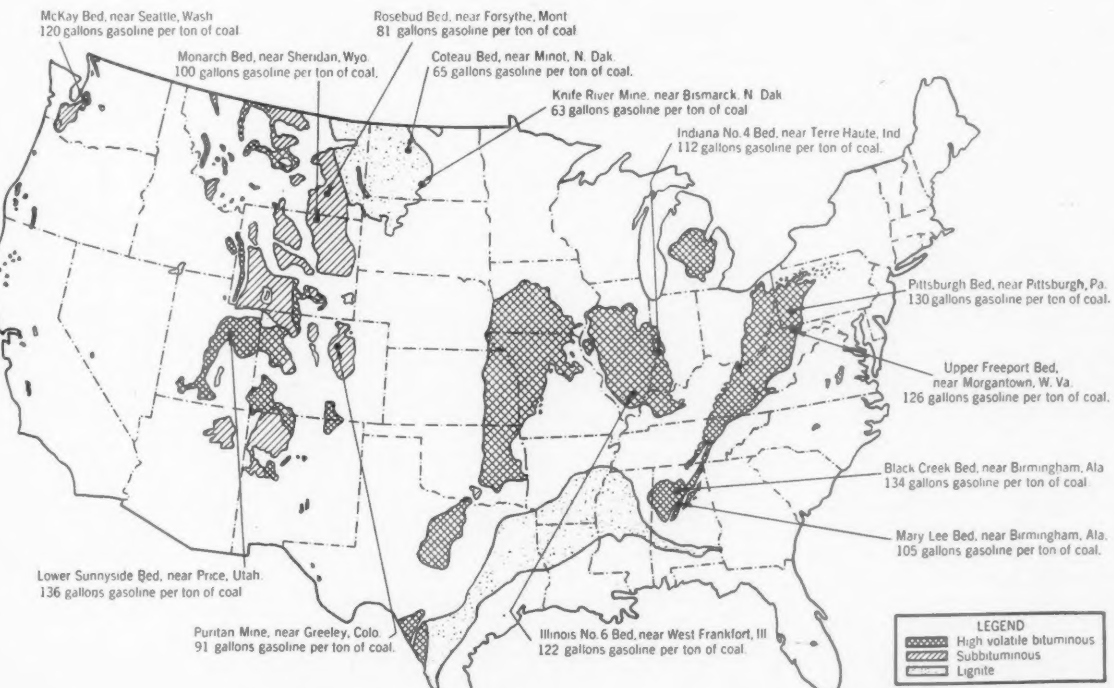
THERE are two main processes for converting coal into gasoline and oil. In the first, the hydrogenation process, finely powdered bituminous or lignite coal is mixed with part of the heavy oil made in the process to form a paste, which is pumped into high pressure (3000 to 7500 lbs./sq.in.) forged reaction vessels, in which, through reaction with hydrogen gas at high temperature, the coal is converted into heavy oil. This heavy oil, with additional hydrogen, is pumped into a second set of high pressure, high temperature reaction vessels in which, with the addition of a catalyst, the heavy oil is converted into gasoline.

In the second process, the Fischer process, the coal is first converted to water gas (a mixture of carbon monoxide and hydrogen), which is then highly purified and pumped into relatively low pressure but reasonably high temperature reaction vessels filled with catalyst, in which is formed a mixture of very poor low-octane gasoline and paraffinic kerosine and gas oil. This Fischer process primary gasoline must be further refined to convert it into gasolines high enough in octane number to be suitable for use in modern U. S. automobile engines.

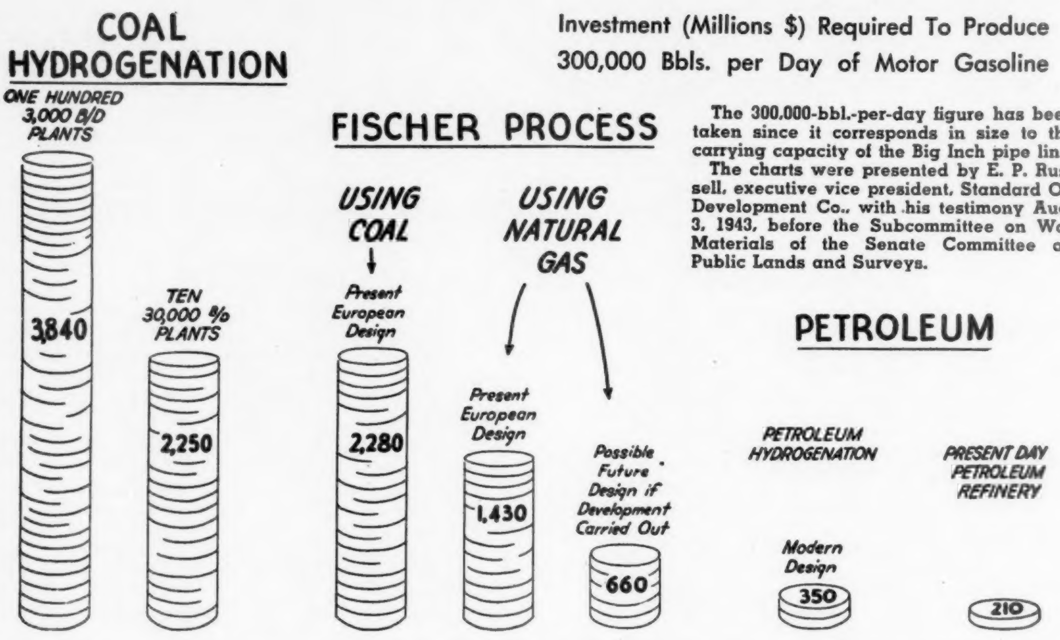
This memorandum outlines the present status of the hydrogenation and Fischer processes and summarizes the raw material and overall steel requirements, as well as investments and operating costs for producing motor gasoline from bituminous coal by means of these two processes.

SUMMARY

In the early 1920's the Standard Oil Co. (New Jersey) was very much interested in the possibilities of converting coal into gasoline and other oil products. About 1925, crude oil was high-priced and known reserves of crude in the U. S. were quite small. These known reserves at the 1925-1926 rate of consumption would have



Gasoline yields from coals tested in Bureau of Mines hydrogenation plant



The 300,000-bbl.-per-day figure has been taken since it corresponds in size to the carrying capacity of the Big Inch pipe line.
The charts were presented by E. P. Russell, executive vice president, Standard Oil Development Co., with his testimony Aug. 3, 1943, before the Subcommittee on War Materials of the Senate Committee on Public Lands and Surveys.

lasted only from 5 to 6 years. Hence, it is only natural that the company should have investigated thoroughly any techniques which might tap other large potential sources of oil, and it was well known that coal reserves were adequate for hundreds of years to come. It was known that the Germans had developed a technique for converting oil which was, even at that time, being utilized on a commercial scale.

In 1927, Standard acquired the rights for application of the hydrogenation process to petroleum, and in 1929 concluded the arrangements under which the rights were acquired for application of the process for conversion of coal into oil. In view of the possibility that conversion of coal into oil might become necessary in the not too distant future, in addition to its own experimental work on conversion of coal into oil, the company contributed considerable sums of money to coal investigations being carried out by the Carnegie Institute of Technology. During the next few years, tremendous crude oil reserves were discovered in the U. S. and, hence, active interest in the hydrogenation process for conversion of coal into oil died down.

High pressure hydrogenation and the Fischer synthesis have been developed and utilized in large commercial installations abroad for converting bituminous coal into gasoline and oil. The first hydrogenated gasoline produced from coal in the U. S. is believed to be that made in the experimental units of the Standard Oil Co. of Louisiana in the summer of 1927. Both these processes are now fully demonstrated both technically and commercially. Quite complete technical data on both processes are available in the U. S. Certain additional technical data would be required if large coal hydrogenation plants were to be built in the U. S. and this information could, if desired, be secured readily from England. The data on the Fischer synthesis are quite complete. If large scale plants following the European designs were to be built in this country it would only be necessary to carry out a certain amount of experimental work on catalyst manufacture and testing.

The high pressure hydrogenation process can be utilized for converting low grade crudes into higher yields of gasoline than can be obtained from crude by other fully developed processes. The amount of steel required, the investment costs and the cost of the gasoline produced are all much lower for oil hydrogenation than for coal hydrogenation. Hence, as crude supplies dwindle, presumably oil hydrogenation would be employed prior to utilization of coal hydrogenation. About 110 bbls. of gasoline can be made from 100 bbls. of crude through hydrogenation, in comparison with the present average of about 45 bbls. and approximately 80 bbls. obtainable through catalytic cracking and polymerization.

The Fischer process can be used for converting natural gas into gasoline and plants

TABLE 1—SUMMARY OF COSTS AND MATERIAL REQUIREMENTS FOR CONVERTING COAL INTO GASOLINE

	By Fischer Process	*By Coal Hydrog.*
Plant Capacity		
Gasoline, BCD*	3,960	2,950
Coal Required (Ash & Moisture Free)		
Short tons per day	2,700	1,500
Short tons per bbl. gasoline	0.68	0.51
Gasoline Quality		
API Gravity	66	62.5
ASTM Octane No.	68	70
Estimated Investments†		
1942 Basis	$30,000,000	$37,700,000
$/B Gaso./D	7,600	12,800
Operating Costs		
Excluding Depr. cents per gallon gasoline	14.7	15.9
Including Depr. cents per gallon gasoline	19.2	22.6
Estimated Steel Requirements–Tons‡		
Including all steel, forgings, alloy, compressors, pumps, etc.	35,100	41,700
Tons/B Gaso./D	8.9	14.1

*Bbls. gasoline per calendar day.
†See Tables 3 and 4 for details.
‡These estimates are quite approximate. See Tables 5 and 6 for details.

TABLE 2—COMPARISON OF METHODS FOR CONVERTING COAL TO GASOLINE WITH METHODS FOR NATURAL GAS AND PETROLEUM

	*Approx. $ Invest.** per Bbl. Motor Gaso- line/Day*	*Approx. Tons Steel per Bbl. Motor Gaso- line/Day*	*Approx. Gasoline § Direct Cost per Gal., incl. normal O.H. but excl. Deprec.*	*Approx. Gasoline § Total Cost per Gal., incl. norm. O.H. and 10% Deprec.*
1. High Pressure Coal Hydrogenation	$12,800	14.1	15.9†	22.6†
2. Fischer Process, European Design, starting from coal	7,600	8.9	14.7	19.2
3. Fischer Process, European Design, starting from natural gas†	4,750	6.5	6.0	8.8
4. Modern High Pressure Hydrogenation of Petroleum‡	1,150	1.4	4.8	3.5
5. Modern Oil Refinery ††, Crude @ $1.20/B*	700	0.7	5.1	5.3
6. Modern Oil Refinery ††, Crude @ $2.00/B*	700	0.7	8.3	8.5

†Natural gas at 5c/1000 CF.
‡Crude at $1.20/Bbl.
§Octane number approximately 68-70 ASTM.

*Crude price at the well.
**1942 costs for complete plant, including all utility supply and auxiliaries.
††Using thermal cracking basis.

for this purpose show much lower steel requirements, investments and gasoline cost than Fischer plants starting from coal. Since the natural gas reserves in the U. S. are so large (tons of new natural gas reserves approximately equal to tons of new crude reserves), it appears probable that the Fischer synthesis would be used for converting natural gas before coal-based Fischer synthesis units would be built.

As pointed out previously, the Fischer process can also be adapted to conversion of natural gas into gasoline. Plants for this purpose involve investment and steel requirements of considerably less than those for plants to start from coal. If sufficient development work were done in the U. S., it is probable that gasoline produced from natural gas (at from 3 to 5c/1000 cu.ft.) by the Fischer process can be made at a cost competitive with gasoline produced from crude, or, in other words, at much less than the cost involved from coal, as original raw material.

A number of possibilities for improvement in the Fischer synthesis step are known to exist, and Standard Oil Co. with several cooperating companies had been planning to conduct an aggressive research and development program in an attempt to carry these possibilities to completion. It has been necessary, however, to utilize all technical and operating personnel on seeking solutions of problems known to be vital to the war effort, and, hence, this aggressive research program on the Fischer synthesis has been postponed until after the war.

EXPERIENCE AVAILABLE

Although oil hydrogenation has been practiced extensively in the U. S., there is no commercial experience available on coal hydrogenation or on Fischer synthesis. Some experimental work on coal hydrogenation has been carried out by the Bureau of Mines and a small amount of laboratory work has been conducted on the Fischer operation.

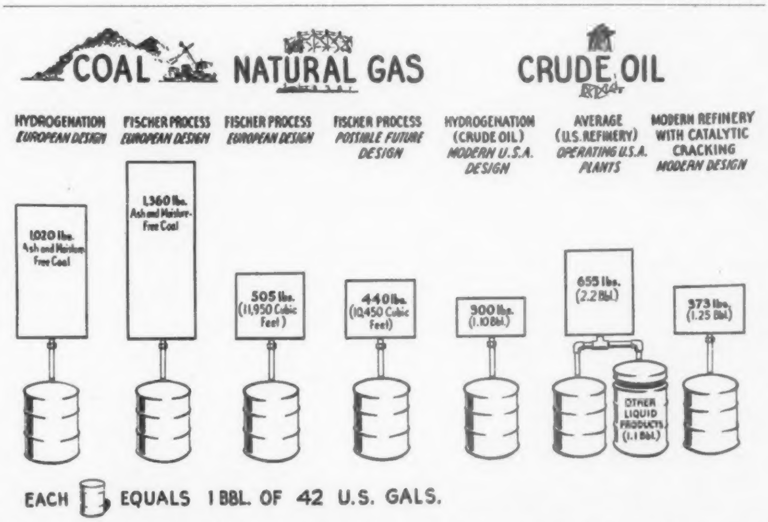
Table 1 shows summarized figures for two available estimates on these processes, when converting coal to gasoline. The figures shown for the Fischer operation are based on a plant producing 3960 barrels per calendar day of gasoline, while the coal hydrogenation plant has an output of 2950 b/cd. Figures are also shown in the table for coal requirements, indicating somewhat greater consumption by the Fischer process (0.68 tons per bbl. of gasoline vs. 0.51 for coal hydrogenation). The gasoline produced in each case is rather low-octane number motor fuel. If aviation gasoline were produced, added investment and operating costs would be involved.

The Fischer estimate was prepared in this country on the basis of process information obtained abroad. It will be noted that coal hydrogenation shows an investment of $12,800 per bbl. per day gasoline capacity, while the Fischer process indicates $7600 per bbl. per day. These figures are based on plants of the capacity shown and would decrease somewhat for larger units, particularly in the case of coal hydrogenation, where it is estimated that a plant of 30,000 bbls. per day capacity would show a cost of roughly $7500 per bbl. per day for a high pressure hydrogena- be compared with the costs of $1150 per bbl. per day for a high pressure hydrogenation plant charging crude petroleum, $4750 per bbl. per day for a present European design Fischer plant charging natural gas as raw material and $700 per bbl. per day for a modern refinery starting from crude petroleum.

The direct operating costs including normal overhead but exclusive of depreciation, amount to 14.7c/gal. of gasoline for the Fischer process and 15.9c/gal. for coal hydrogenation. When 10% depreciation on process equipment and 5% on auxiliaries is included, the total costs are 19.2c/gal. and 22.6c/gal. For a plant having a capacity of 30,000 b/d it is estimated that the cost of gasoline exclusive of depreciation would be about 12c/gal. and about 15.5c/ gal. with depreciation. These costs should be compared with costs of other methods of producing gasoline, as follows (See Table 2).

Results of British Study

In 1938, the Falmouth committee (committee of Imperial Defence, subcommittee on oil from coal) appointed by the British Government to assay the advisability of installing in England hydrogenation or Fischer process plants for making gasoline from coal issued its careful and compre-



Total raw materials required to produce one barrel of gasoline, including requirements for power, steam, etc.

TABLE 3—INVESTMENT FOR PRODUCTION OF 2950 BBLS. PER DAY OF GASOLINE BY COAL HYDROGENATION

	Marks in 1936	$ in 1936 @ 40c to mark	Est. Cost in 1942†
Hydrogen Mfg. & Compression	14,989,000	$ 6,000,000	$ 8,100,000
Hydrogenation	19,067,000	7,620,000	10,300,000
Distillation and Tankage	3,680,000	1,470,000	1,990,000
Tie-in Lines	397,000	160,000	220,000
Spare Parts	800,000	320,000	340,000
Utility Supply, Shops, Lab. etc.	25,000,000	10,000,000	13,500,000
	63,933,000*	$25,570,000*	$34,540,000*
Engineering	3,800,000	1,520,000	2,050,000
First Charge Catalysts	2,000,000	800,000	1,080,000
	69,733,000	$27,890,000	$37,670,000

*Contingencies @ 10% included in individual items.
†Taking 1.35 times 1936 cost.

hensive report. It was doubtless from study of such figures as contained in the table just presented which led the Falmouth committee to conclude "in these circumstances, it is abundantly evident that so long as the price of imported fuel remains in the neighborhood of the present figure, the case for home produced oil, judged by purely economic standards, falls to the ground. Hence, it follows that if it is desirable for any of the reasons mentioned in paragraph 238 to produce oil from coal or other indigenous material, government assistance in one form or another must be forthcoming."

Coal Hydrogenation

The production of gasoline from coal involves two major steps: a. hydrogenation of coal into heavy oil; b. second stage, hydrogenation of heavy oil to gasoline.

Full experience is available in this country on the second step. In the first step engineering information would be required on coal grinding and pasting, paste pumping, coal hydrogenation, type of catalysts, finishing final gasoline, etc. Full information could be obtained from Imperial Chemical Industries of Great Britain, who operate a commercial plant. If commercial plants were to be built it probably would be desirable to conduct pilot plant tests on specific American coals; such tests could be run by the I.C.I. in England, or this information may be available from work carried out by the Bureau of Mines.

Fischer Synthesis

All of Ruhr-Chemies information on this process was made available in 1938. Sufficient information is available for design of plants, although it is doubtful whether the best and cheapest plant could be constructed from the information available. It would, however, be necessary to conduct some work on catalyst manufacture and catalyst testing to make sure that the catalyst could be duplicated in this country.

Numerous possibilities for improvement in the process both as regards investment and product quality merit investigation. A comprehensive development program had been projected along these lines, but has been postponed in order to permit concentrating on solution of problems vital to the war effort.

The Fischer synthesis can also be used to convert natural gas into gasoline and plants for this purpose represent investments which are much lower than those involved in Fischer synthesis with coal as starting material. Furthermore, if sufficient development work were done and if it were successful, the cost of producing gasoline by the Fischer synthesis from natural gas probably would be competitive with the cost of gasoline produced from crude. Thus Fischer synthesis gasoline from natural gas will be very much cheaper than Fischer synthesis produced from coal.

INVESTMENTS

Coal Hydrogenation

A detailed estimate was available for a coal hydrogenation plant producing 2950 bbls./cd of gasoline as prepared in 1936 by associates in the Netherlands. This cost was expressed in marks and in Table 3 this cost has been corrected to 1936 costs in dollars using a figure of 40c per mark which may be questionable. However, comparison of these coal hydrogenation costs with similar estimates prepared in England led to the assumption at that time that the conversion using a 40c mark was satisfactory. U. S. costs in 1936 were then corrected to 1942 conditions using a factor of 1.35. This plant, although of a capacity extensively used abroad, might be considered as a rather small capacity here and investments costs would be somewhat lower if larger capacities were employed. The items shown for engineering were left exactly as in the estimates made abroad and may be slightly low based on present day American conditions.

Fischer Synthesis

The estimate used here is based on a design prepared in this country based on the Ruhr-Chemie data for the Fischer synthesis proper. Figures were obtained from local equipment suppliers on cost of water gas generators using coal as the feed material. These costs have likewise been corrected to 1942 conditions. Table 4.

OPERATING COSTS

Bituminous Coal Hydrogenation

The coal consumption required for this plant was obtained from information abroad indicating about 0.51 tons of coal per bbl. of gasoline produced. This includes coal for hydrogenation, hydrogen production, and for generation of all utilities. The consumption is expressed in terms of ash-and moisture-free coal. Corrections are therefore necessary to obtain tons of coal as received.

In the operating costs a price of $2.75/ton of ash- and moisture-free coal has been assumed. Both operating and investment costs will vary to some extent depending on the type of bituminous coal employed. Labor requirements are based directly upon those indicated by experience abroad using American labor rates.

Depreciation is included at 10% for main process equipment with 5% on utilities and auxiliaries. A burden charge of 60% is used on maintenance, supplies and labor. This charge is representative of costs in the petroleum industry and includes items such as shops, fire protection, medical department, guards, general roads, utility distribution, etc. On general administration, which covers executive control, a corresponding figure of 10% has been applied, which likewise is in line with experience in the industry.

TABLE 4—INVESTMENT FOR PRODUCTION OF 3960 BBLS. OF GASOLINE PER DAY BY FISCHER SYNTHESIS USING BITUMINOUS COAL

	Est. Cost in 1938	Est. Cost in 1942*
Synthesis Gas Production	——	$12,000,000
Synthesis Plant	7,000,000	8,800,000
Fischer Product Cracking Plant	1,600,000	2,000,000
Catalyst Plant	——	750,000
Utility Supply, Shops, etc.	——	5,300,000
		$28,850,000†
Engineering	——	1,000,000
Initial Catalyst Charge	$180,000	225,000
		$30,075,000

*Taking 1.25 times 1938 cost.
†Contingencies @ 10% included in individual items.

It will be noted that the cost of producing gasoline without depreciation on investment in a 2950-bbl./day plant is 15.9c/gal., with a total cost of 22.6c. With larger scale production, for example, at a capacity of around 30,000 b/d, it is believed that the total cost would be reduced to about 16c per gal. Undoubtedly some of the high cost shown for the operation is a reflection of the high investment costs based on 1942 conditions. In any event, both the investment cost and operating cost estimates are reasonably close to those contained in the British Falmouth Committee Report which gave $11,300/b gasoline/d as investment; direct operating cost, before depreciation, of 12c/ U. S. gal.; and operating cost, including 10% depreciation of 17½c U. S. gal.

Fischer Synthesis

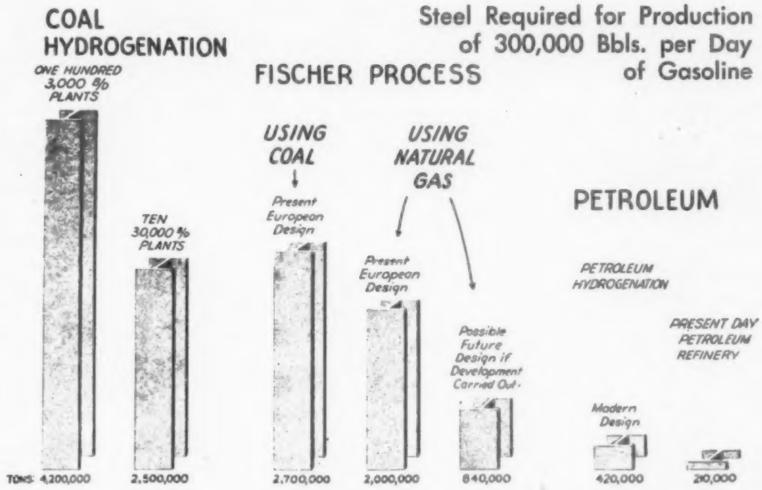
The figures used on this operation are set up on the same basis as used for coal hydrogenation. Detailed operating costs were worked out in this country based on the Ruhr-Chemie's process data for the Fischer synthesis proper. To these costs have been added figures obtained in the U. S. covering water gas production from coal. It is doubtful that in using the Fischer process any great reduction in cost would be obtained by constructing larger sized plants.

It will be noted that the cost ex depreciation for gasoline by the Fischer process amounts to 14.7c/gal. with a total cost of 19.2c/gal.

The crude Fischer product in this estimate is worked up by thermal cracking (gas reversion type) into motor fuel. Since these figures were originally prepared, catalyst cracking has been developed and it is quite possible that the Fischer product might be worked up in this way whereby higher octane number material would be produced.

Production of aviation gasoline by the Fischer process has not been studied. Added costs would undoubtedly be involved probably with some reduction in yield.

As stated previously marked possibilities for improvement in the process are thought to exist particularly when using natural gas instead of coal as raw material.



STEEL REQUIREMENTS

Coal Hydrogenation

Good information is not available on the direct steel requirements for coal hydrogenation. The method used in approximating the steel requirements is shown in Table 5. The estimate as obtained abroad was broken down into material cost for ordinary steel, forgings, compressors, and pumps. These items were converted to U. S. dollars and then divided by the cost per ton of steel existing at that time. Alloy steel was determined as a percentage on total steel tonnage based on experience with Hydro plants in this country. This method is approximate and only provides a general idea of steel requirements.

Fischer Synthesis

In the case of the Fischer synthesis plant, an estimate had been prepared in this country and steel was estimated directly from this estimate as shown in Table 6 (13,426 tons). A corresponding figure was obtained for steel for the gas preparation equipment (11,000 tons). Steel for the reversion plant, catalyst plant and utility supply was obtained using the same method as employed for the coal hydrogenation plant. Pump and compressor tonnage was obtained in a similar way using a unit cost of $1700 per ton, except in the synthesis plant, where an actual weight of steel was available.

COMPARISON WITH OTHER METHODS

Production of gasoline from bituminous coal by hydrogenation or Fischer synthesis should be compared with the following other methods:

(a) Crude oil processing in a modern refinery.

(b) High pressure hydrogenation of crude petroleum.

(c) Fischer synthesis starting with natural gas.

Table 2 summarizes the investments, steel requirements and operating costs for these methods in comparison to production from coal.

It will be observed that production of gasoline in a modern oil refinery starting with crude petroleum is the cheapest method for production of gasoline today. The current investment per bbl. of motor gasoline for a complete refinery amounts to about $700 per bbl. of gasoline per day and the cost of gasoline production is about 5.3c per gal. for crude at $1.20 per bbl. at the well (lower than current crude prices). When, as and if crude supplies become more limited, and crude price should increase to $2 per bbl. it will be noted from the table that the gasoline cost is 8.5c per gal. at the refinery, which is still considerably less than the cost of production from coal by either hydrogenation or the Fischer process. Steel requirements are also less, amounting to 0.7 tons per bbl. per day gasoline capacity compared to 8-14 tons per bbl. per day for treatment of coal.

As mentioned previously, the Fischer process can be adapted to conversion of natural gas into gasoline. Estimates made

TABLE 5—APPROXIMATE STEEL REQUIREMENTS FOR COAL HYDROGENATION PLANT TO PRODUCE 2950 BBLS. PER DAY OF MOTOR GASOLINE

	Material Cost, 1936 Marks	*$ Cost in 1936*	*Est. $ Ton* 1936*	*Total Tons Req'd*
Steel Towers, Drums, Piping, Misc.	32,824,000	13,130,000	425	31,000
Forgings	5,505,000	2,200,000	450	4,900
Alloy	775,000	310,000	†	1,400†
Compressors	3,305,000	1,320,000	600	2,200
Pumps	6,841,000	2,740,000	1250	2,000
			Total	41,700

*Estimate based on 1942 and 1930 construction costs corrected to 1936 conditions.
†Tons alloy estimated by taking 7% wt. of steel towers, drums, piping, misc. plus forgings.

Table 6—Approximate Steel Requirements for Fischer Plant Using Coal to Produce 3960 Bbls. per Day of Motor Gasoline

	Est. Mat. Cost in 1942	*Est. $/Ton*	*Tons Required*
Steel Towers, Drums, Piping, Etc.			
Gas Prod. Plant	——	——	11,000
Synthesis Plant			13,426
Cracking Plant	$1,400,000	575	2,430
Catalyst Plant	550,000	575	960
Utilities and Shops	3,000,000	500	6,000
			Subtotal 33,816
Pumps and Compressors			
Gas Prod. Plant	230,000	1,700	135
Synthesis Plant	——	——	746
Cracking and Catalyst Plants	150,000	1,700	90
Utilities and Shops	500,000	1,700	295
			Subtotal 1,266
			Total 35,082

up using present European design for the synthesis equipment have been summarized in Table 2. It will be observed that the estimated investment is less than for production of gasoline from coal, although higher than that by present crude petroleum refining, as would be expected. The estimated cost of production of gasooline from 3c to 5c natural gas appears to be competitive with production from crude when a crude price of $2 per bbl. is realized. Steel requirements likewise are less than production from coal, but much higher than crude oil refining. A number of possibilities for improvement of the Fischer process are believed to exist and if sufficient development work were done and if successful, it is probable that gasoline produced from natural gas could be made at a cost competitive with gasoline from crude.

High pressure hydrogenation of petroleum is well worked out and represents the most effective utilization of existing petroleum supplies. This method shows considerably lower investments than production from coal or Fischer synthesis using natural gas, although somewhat higher than with present-day refining methods. The cost of gasoline is considerably lower than production from coal and appears competitive with present-day refining methods when somewhat higher crude prices apply. Steel requirements are much less than for coal hydrogenation or Fischer process.

Oil Refining Is Lowest Cost

It has been our picture that for present price levels, production of gasoline by modern refinery methods, which include catalytic cracking, represent the cheapest methods for production of gasoline and likewise require the least steel. Moreover, it is felt that, if sufficient development work were done on the production of gasoline from natural gas by the Fischer process, and if this work were successful, this method might be competitive with present-day refining of crude petroleum.

As petroleum supplies become more limited, and the price of crude thereby increases, other competitive methods, such as those discussed above, will become more attractive. The first of these to come into use would probably be high pressure hydrogenation of crude petroleum. Since this method uses petroleum very efficiently, the supply of petroleum would be extended since all of the crude can be converted into gasoline without production of heavy fuel.

Coal Is Last Resort

We have pictured that only after the application of petroleum hydrogenation and Fischer process using natural gas would attention be given to production of gasoline from coal. From the figures in this memorandum it appears that production from coal might first be effected using the Fischer process rather than coal hydrogenation since investments and operating costs are somewhat lower. On the other hand, it should be kept in mind that if larger scale coal hydrogenation plants were erected than shown in detail in this memorandum, the costs for coal hydrogenation would be competitive with those of the Fischer process.

Shnidman Reports on Coke Ash Structure

INDUSTRIAL and Engineering Chemistry, December 1943, published an article entitled "Ash Structure in Coke," by Louis Shnidman, Rochester Gas & Electric Corp., and chairman of the American Gas Association's Fuel-Flue Gases Committee. The material was originally presented before the Division of Gas and Fuel Chemistry at the 105th meeting of the American Chemical Society in Detroit, Mich.

Mr. Shnidman describes the results of a study of a series of thin sections of coke with and without the admixture of breeze, both before and after burning. It is found that the distribution and structure of ash in coke in relation to the combustible is dependent on the structure of the original coke.

It is also indicated that the combustible material surrounds and envelops the ash residue. The addition of 5 per cent breeze to the charged coal has little effect upon the structure of the resulting coke or its ash residue, Mr. Shnidman points out.

The direction in which a coking coal expands in respect to its banded structure is indicated in a preliminary manner.

Dates Set for Technical Gas Conferences

CHARLES F. TURNER, chairman of the Technical Section, American Gas Association, has announced the following dates for the Section's annual Spring conferences:

21st Annual Distribution Conference—Hotel Statler, Cleveland, Ohio, Tuesday and Wednesday, April 18 and 19.

Joint Production and Chemical Committee Conference—Hotel Pennsylvania, New York, N. Y., Tuesday and Wednesday, June 6 and 7.

A. C. Cherry, Cincinnati Gas & Electric Co., Cincinnati, will preside at the Distribution Conference. Co-chairmen of the Production and Chemical Conference will be V. J. Altieri, Eastern Gas & Fuel Associates, Everett, Mass., and F. J. Pfluke, Rochester Gas & Electric Corp.

Gas Engineering Authority Dies

Garnet W. McKee

GARNET W. McKEE, inventor, gas engineering authority and head of Eclipse Fuel Engineering Company, Rockford, Ill., died last month. A member of the Industrial and Commercial Gas Section of the American Gas Association since it was first organized, Mr. McKee was recognized for many years as a leading industrial gas equipment manufacturer.

A native of Canada, Mr. McKee first came to the United States in 1904 as chemist for the Detroit Gas Company. Later, he was superintendent of gas manufacture and in 1905 was named head of Detroit's gas distribution system. He was industrial engineer for The Peoples Gas Light & Coke Co., Chicago, starting in 1906 and continued his experimental work there. He founded the Chicago Industrial Appliance Co. in 1910 and moved to Rockford the same year, founding the Eclipse Fuel Engineering Co.

The breadth of Mr. McKee's inventive genius is reflected in a list of more than 100 patents he held on a variety of devices, including a variable speed motor control, a thermostat, and various gas burner controls.

Laboratories

GEORGE E WHITWELL, *Chairman*
R. M. CONNER, *Director*
W H. VOGAN, *Supervisor, Pacific Coast Branch*

Two Naval Academy Instructors Visit Laboratories

Lt. R. B. Kleinhans and Lt. Commander J. B. Heinicke take time out from their Naval Academy duties to visit the Cleveland Laboratories. K. H. Flint is explaining recent research developments

WHILE many visitors call at the American Gas Association Testing Laboratories, it is seldom that two former engineers, now Navy officers arrive together. Lieutenant Commander J. B. Heinicke and Lieutenant R. B. Kleinhans are shown discussing recent research developments with K. H. Flint, assistant chief research engineer. Both are now stationed at the United States Naval Academy at Annapolis where they are instructors in chemistry, physics and electrical engineering. They were among the first of the Laboratories' staff to respond to our country's call. Since then they have received well-earned promotions.

Lieutenant Commander Heinicke obtained his degree of Bachelor of Engineering in Gas Engineering from Johns Hopkins University in 1933. Prior to joining the Laboratories' staff he was employed by the Consolidated Gas Electric Light and Power Company of Baltimore.

Following graduation, Lieutenant Kleinhans completed a course of graduate study at Western Reserve University. In addition to several other teaching assignments, he was for some time a member of the staff of Athens College, Athens, Greece.

Recent additions to the Laboratories' Honor Roll bring its total to 41, these including one woman who enlisted in the Women's Marine Corps. Many of this number are now serving on fighting fronts all over the globe. The entire gas industry is rightly proud of them all.

New Research Bulletin on Burner Design

NEW and valuable data on design and application of gas appliance burners are presented in Research Bulletin No. 20, shortly to be released for publication by the Committee on Domestic Gas Research of the American Gas Association. Recognizing the great importance of burner design in the further development of domestic gas appliances, extensive study has been devoted to its fundamentals as a part of the extensive domestic gas research program now in progress at the Association's Laboratories. Three research bulletins previously published covered conventional Bunsen type burners. Those utilizing all air needed for combustion as primary air are now similarly treated.

Contrasted with burners of the ordinary atmospheric type, those employing all air for combustion in the form of primary air present important differences. Several important advantages may be attained through their use as demonstrated by the studies now reported. Chief among these are reduced combustion space, greater heat liberation and higher rate of heat transfer. Design features to best accomplish desired results are fully discussed. These apply to burners operated on low gas pressures commonly employed, as well as those supplied for use under higher pressures.

A chapter is devoted to performance of various small burners employing all air as primary air. These are considered from the standpoint of their application to gas range top sections. However, they should be capable of application to other types of domestic gas appliances as well. Experimental results clearly show possibilities of high efficiencies and good heat distribution. For gas range application particularly, importance of advantages offered by the use of such burners deserve special attention.

Cribben & Sexton Wins "E" Award

CRIBBEN and Sexton Company, Chicago peace-time manufacturers of gas ranges, was awarded the coveted Army-Navy "E," for excellence in war production, at colorful and impressive ceremonies at the factory the evening of January 3.

Manufacturing products of war is no new experience for Cribben and Sexton Company as during World War I the company was engaged in the production of 155 MM shells. In the present war, conversion to war work started in January of 1942, and total plant conversion was effective by July of 1942, when production on gas ranges was suspended and all plant facilities were devoted 100% to war work.

Cribben and Sexton has had a diversified war production experience, having produced tank armor plate, ammunition boxes, and army hospital tables. It is currently engaged in the manufacture of high explosive shells and in making airplane subassemblies for Curtiss-Wright Corporation, Willys-Overland Motors, Howard and Higgins Aircraft.

Organized in 1872, Cribben and Sexton Company has played a prominent role in the stove industry and has to its credit many innovations and improvements in range construction and design.

HEATING BASEMENTLESS HOUSES

(Continued from page 62)

gested arrangement of the unit. It should be emphasized that all sketches of equipment are merely schematic with no attempt at actual design. Dimensions are only approximate.

While this unit is designed for one story bungalows it is arranged so a connection could be taken from the supply plenum to furnish heat in upstairs rooms.

Except in special cases no supply ducts to any rooms are necessary beyond a run of a few inches from the supply plenum to the register. It will be advisable to bring a few returns back from the most distant corner of each bed room. These returns can be connected to planned floor joists in order to reduce duct work and cost to a minimum. A return from the living room can be made near the unit location.

House Planned for Heater

It will be apparent from the foregoing that the basementless house will have to be planned to meet the peculiarities of the heater. The heater may not lend itself to installation in all basementless houses as now designed. This does not appear serious, however, as most small houses of this type have a central hall or probably could be planned that way. A study of the suggested arrangement for two such houses, Plan A and Plan B in Figures 7 and 8, will demonstrate the simplicity and effectiveness of this method.

The domestic hot water for basementless houses has usually been supplied by a small storage type of heater which is placed in the kitchen or utility room. It is suggested that a water heater be incorporated into the design of the forced warm air heater. The advantages of such an arrangement are that it should be cheaper to furnish and install a combination unit rather than two separate units, it eliminates the necessity for two flues, it allows more floor space in an already overcrowded kitchen or utility room and it would usually mean shorter gas lines because gas would already be piped to the heating unit.

The suggested arrangement of the water heater is shown schematically in Figure 6. The water heater has no connection with the space heater except that both rest on the same support and connect to a common flue.

The compactness of the heater should allow it to be manufactured at low cost. It does not have to be supplied with a fine-finish outside jacket as it will always be out of sight. It will not require filters or humidifiers which add to the expense of the conventional winter air conditioner.

This system will not require a brick chimney. One "Transite" type flue can take care of both the water heater and the space heater.

Equipment Space a Problem

There has always been a problem of supplying space for the gas meter, water meter and electric meter in a basementless house. The gas meter is a particularly serious problem because it must be in a heated, ventilated and accessible space. With the suggested layout, part of the space over the heater can be prepared as a closet for these meters. This space would meet all of the requirements mentioned above. For suggested arrangement see Figure 9.

There is also the possibility of furring out the inside wall of a living room to form an enclosure for the unit so it would be partly in the partition and partly in the furred-out enclosure. The top of this enclosure could become an attractive mantel. This would eliminate the necessity for using the central hall closet.

It is suggested that designers and builders of prefabricated houses be interviewed to see whether or not it is practical to design all of their small basementless houses so they can adopt this type of heating system.

There are, no doubt, other solutions to the cold floor problems of basementless houses. Panel heating appears to be one other such method. Its chief drawback at present over forced warm air would seem to be higher operating cost. This of course is an important factor in developments built for the low-income group. I believe manufacturers who are interested in forced warm air heating will have to develop new equipment in order to overcome satisfactorily the cold floor condition which will otherwise be found in basementless houses of the future.

RADIANT-TUBE HEATING

(Continued from page 70)

mined that the tubing of a wall thickness of approximately 1/8 in. was in most cases strong enough mechanically and it kept the internal temperature of the tube at a very low differential above the temperature of the outside radiating surface.

It is interesting to note that the temperature differential between the inside and the outside of a radiant tube is somewhat higher for the thicker-wall tube, as would be expected, but it is not a great deal higher; further, the temperature of the inside wall of the tube is really very little higher than the outside wall of the tube in either case, and even for operating temperatures of the tube of 1800 deg. F. on the outside, the rate of heat dispersion during the soaking position of the cycle lies between 10 and 5 B.t.u. per square inch per hour, which is well within the allowable low limits.

As stated previously, it is more important to limit the temperature of the tube than the rate of dispersion, and the thick-wall tube would burn up as fast as the thin-wall tube if the 1800 deg. F. temperature were exceeded by any appreciable amount.

Advantage of Position

The one great advantage that the radiant-gas-fired tube has for heating applications is that it can be placed exactly where it is required to do the best job of heating so that it can take the advantage of position in the furnace rather than just depend on radiating to the general furnace brickwork and charge. Furthermore, the radiant tubes may be made in any length; and, particularly if the heat application is vertical, as in a bell furnace, pit furnace, or in any type of batch charge, the major heat release may be made from the bottom of the tube to allow the heat to flow upward, and only one zone of temperature control would be required.

A continuous belt type furnace is used with a special atmosphere for bright hardening and decarburization control on such material as bolts or small pieces which adapt themselves to the belt type of conveyor. Radiant tubes are placed above and below the belt so that they radiate

directly upward and downward immediately at the charge and from below at the belt conveying it. These tubes are of the hairpin type and are placed flat in a horizontal position. The tubes are welded to a plate which is bolted to the furnace frame with heavy gaskets so that there could be no gas leakage around the tube.

Fig. 10 shows a furnace in which an application of the hairpin heating element is made to a pusher-type furnace through which baskets are moved on grids to convey small stampings for bright annealing. Here, too, the method of heat application is direct to the charge.

New Application

A fairly new application of the radiant tube has been made in the heating of gases or air in separate heaters or in the same furnace frame for recirculation of special atmospheres or air free from products of combustion. This application of radiant tubes within the furnace itself is suited to the furnace design. One illustration is given of a low temperature bright stress relieving furnace in which the radiant tubes are placed above a false arch in the furnace and in the path of the recirculated gases so that the heat in the gases can be restored before they are returned to the furnace chamber.

A much broader application of this type of radiant heating may be made to external heaters which are self-contained units for heating air or gas as parts of processes which are carried out in separate furnace units. In one particular unit some 750,000 cu.ft. of coke-oven gas are to be heated each hour, up to a temperature of 1500 deg. F., as part of a direct metal reduction process. The same type of heater could be used for preheating air for recirculating applications.

In a survey of this type of radiant-tube applications the question might be asked as to why the heat application is made through the radiant tube with the gas or air passing over the tubes rather than in the reverse manner in which the chamber would be heated and the gas to be heated passed through within the tubes. Here it is to be pointed out that the radiant tube can be placed in the furnace where its heat can be best dispersed, and the products of combustion leave the other end of the tube. The method of installation takes care of expansion and the junction of the tube to the furnace frame is kept gas tight while the tube itself will not permit any of the combustion gases to enter the chamber.

It would be much more difficult to try to collect heated gases in a general header and keep all of the joints tight. Further, in a heater of this type, the volume of the gas and air being burned is much lower than the volume of the air being heated, and therefore the volume of combustion gases lends itself much more readily to be retained in the firing tubes than would the volume of the gas to be heated.

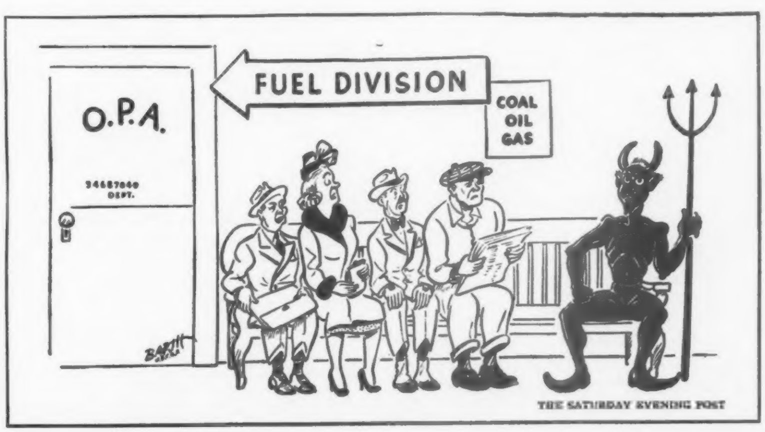
Probably the most important part of the radiant tube application is the type of burner which has to be used to keep the rate of radiation constant throughout the entire exposed portion of the radiant tube. To accomplish this in some tubes the manufacturers depend on on-and-off control with an ejector to remove the gases on the basis that when the gas is burning it is burning the entire length of the tube.

The burner applied to Wilson tubes is known as the dual pressure type burner. In this burner, gas and air are delivered at constant pressure to the burner orifices, and the primary and secondary air inlet points are carefully determined by calculation and set to the required size in assembly. In this type of burner the flame length is practically constant for any position of turndown, but of course the rate of dispersion depends on the amount of gas burned in the tube. This type of burner is required for all horizontal tube applications and is used in vertical tube applications where several fuels may be used at different times of the year or where only exceptionally dirty gas is available as all of the burner orifices are large and no small ports present themselves where solids can be collected.

Where high pressure clean gases are available an inspirating type of burner in which the pressure of the gas inspirates the required amount of air can be used in vertical radiant tubes. Of course this burner operates with the gas passing through a small size spud to create inspirating velocities and is not suitable for use with dirty gas.

In all radiant-tube applications, arrangements are made so that the burners are ignited electrically from spark plugs, and usually the ignition system is tied in with gas and air pressure switches and gas safety valves so that the gas pressure must be available and the air blower operating before the gas is turned in to the radiant tubes for ignition.

The mechanical details of the radiant tube application are rather completely worked out, and while there are undoubtedly many new and interesting uses to be made of this method of heating, the engineers who are in this business understand the limitations and applications of the radiant tubes and usually can, with a thorough study, produce excellent furnaces built around this very successful method of heat application.



Kaiser Appointed

Fred A. Kaiser

FRED A. KAISER has been appointed assistant to the president of Detroit-Michigan Stove Company, it was announced by John A. Fry, president of that company. Prior to his elevation to the new position, he was sales manager of the company.

Mr. Kaiser has been associated with Detroit-Michigan Stove Company for the past ten years.

ALUMINUM AND MAGNESIUM

(Continued from page 86)

taining brines, as in Michigan, the ocean water, as in Texas, and two minerals, magnesite, $MgCO_3$, and dolomite, the double carbonate of calcium and magnesium. Various processes are used to convert these materials into metallic magnesium. The brines are electrolytically treated, and the solid ores after conversion to magnesium oxide are reduced either by the ferro-silicon process which uses gas for heating the retorts or the carbothermic process which uses natural gas for the shock-cooling of magnesium vapor.

The relatively pure magnesium so produced is not used to any extent in the metal trades, but is alloyed primarily with aluminum, zinc, and manganese. The purpose of using alloys is to improve the low strength of pure magnesium. The mechanical properties of the alloys are, in general, about in the same range as aluminum alloys. Magnesium alloys, however, are markedly lighter, in general weighting about .066 pounds per cu.in. contrasted with a weight of about .1 pounds per cu. in. for aluminum alloys. This difference of 35% in the weight of magnesium alloys makes them highly desirable for use, particularly in military aircraft. Whether they will be as widely adopted for civil use is open to doubt on account of certain advantages of aluminum alloys which may overbalance the weight differential.

Magnesium alloys can be used for sand castings, permanent mold castings, and die castings. Wrought magnesium products are available in various shapes and as tubing, sheet or forgings.

At the present time, the Subcommittee on Project No. 1 has confined its studies to the heat-treatment of magnesium sand castings since this appeared to be the most important field for the application of industrial gas. Although there are a number of sand-casting alloys in use, compositions similar to the Dow Chemical Company's "Dow Metal H" are most frequently employed. This alloy has between 5.3% and 6.7% aluminum; 2.5% to 3.5% zinc; at least .15% manganese, and not more than .5% silicon. Magnesium makes up the remainder except for minor impurities. This type of alloy appears to be the best for general foundry use and is quite suitable for applications where salt water corrosion resistance may be a factor. Another type of alloy that is used to some extent is similar to the Dow Metal "C" alloy in which the aluminum is between 8.3 and 9.7% and the zinc 1.7% to 2.3%, manganese at least .1%, silicon not over .5%, and the balance magnesium except for minor impurities. This type of alloy is recommended for maximum pressure tightness and for permanent mold castings.

Use of Gas for Magnesium

Part I of this report includes a brief outline of the use of gas in the aluminum industry and it therefore seems appropriate to outline the parallel uses for gas in the magnesium industry. Some of these have already been mentioned in connection with the production of magnesium. Here there is a striking difference between aluminum and magnesium because, thus far, there is no process for making aluminum by the use of gas whereas the direct reduction of magnesium ores is being successfully carried out by two processes in which large amounts of gas are being employed. A brief description of both processes will be found in the AMERICAN GAS ASSOCIATION MONTHLY, October, 1943. The carbothermic process uses carbon to reduce Mg O to magnesium vapor which is shock-cooled with gas.

The second process, originally developed in Canada, has been adopted by a number of United States plants including Ford, National Lead, New England Lime, and New Jersey Zinc Company. Gas is used in this process to heat retorts in which the magnesium is sublimed from the calcined ore by the reducing action of ferro-silicon.

Regardless of how the magnesium may have been manufactured, it is usually melted and alloyed in gas- or oil-fired melting furnaces. In general, melting furnaces with steel pots are used, but experiments with reverberatory furnaces are under way and give promise of considerable success. The principal objection to the steel crucible is its relatively short life, making not only a costly, frequent replacement necessary but introducing the hazard of fire if molten magnesium is spilled upon the burners or on the floor. The foundry practice for magnesium is highly specialized and quite different in certain respects than that required for other metals. This report will not go into the many details which must be carried out for successful magnesium casting, but it is well to bear in mind that the quality of finished product is dependent in part upon careful control of foundry practice, particularly as regards proper melting and super-heating temperatures and fluxing as well as pouring operations.

Although magnesium castings may be used as cast, it is frequently desirable to heat-treat them to develop maximum physical properties. This heat-treatment is carried out in two parts: first, solution heat-treatment to increase the tensile strength and the elongation. This is generally applied for those products which require shock resistance. When increased hardness and a high yield strength are required, a subsequent aging or precipitation treatment is also used.

Tappan Wins "E" Star

A STAR has been added to the Army-Navy "E" award made to the Tappan Stove Company, Mansfield, Ohio, last June. Symbolic of six months of continued service in the war of production, the new star was presented to P. R. Tappan, president of the firm, in the presence of all employees.

The Tappan record in the manufacture of products for the armed forces includes not one rejection, a low of 1.6% absenteeism and consistent delivery ahead of schedule.

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15 years' broad experience manufacturing gas—specialized in low pressure and high pressure transmission and distribution—Inventory—appraisal—accident prevention—now active duty U. S. Navy—Commander U.S.N.R. Long range planning to future **Post War connection** medium size property—location immaterial—Married with family. (43) **1475.**

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